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ELDERLY TRANSPORTATION TECHNOLOGY

by

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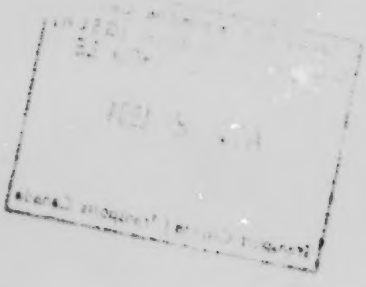

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17. Abstract

This report concerns an investigation of the transportation needs of seniors in Canada up to the year 2026. The objective of the study was to define topics in the area of transportation technology or systems for possible research and development. Through literature reviews and discussions, an attempt was made to establish the elderly's transportation habits, needs, and problems in terms of their demographic and social/psychological characteristics. Four basic groups of seniors emerged, and six key issues in their transportation accessibility were identified. Nine research and development concepts were defined and evaluated.

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17. Résumé

Ce rapport rend compte de l'étude faite sur la demande de transport par la population âgée du Canada d'ici l'an 2026. L'objectif de l'étude était d'établir des sujets de recherche et de développement en matière de technologie et de systèmes de transport pour le groupe visé. Par une recherche documentaire et des interviews, elle a entrepris à relier les besoins, les habitudes, et les problèmes de transport des personnes âgées aux caractéristiques démographiques et socio-psychologiques de celles-ci. Quatres groupes se sont distingués, et l'on a put constater six facteurs à leur accessibilité au transport. Neuf concepts pour la recherche et le développement ont été définis et évalués.

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SUMMARY

This report represents a working paper on the forms of technology suitable for the transportation needs and habits of the elderly anticipated over the next 40 years. The study represents an overview of the above subject in relation to the anticipated physical, demographic and social/psychological characteristics of seniors. The results in terms of transportation-related issues are summarized as follows:

Demographic Factors:

- The total number of seniors (over 65 years of age) is expected to increase from 2,362,000 in 1981 to 5,879,000 in 2026, an increase of 150%.
- Over that period the proportion of elderly females will increase from 38% to 46% more females than males.
- Over that period the proportion of late elderly (over 75 years) will increase from 59% to 65% of early elderly (65 to 75 years of age).
- The increasing numbers of late elderly will result in a higher level of physical disability of seniors.
- An increasingly high home ownership by seniors will be expected resulting in geographic dispersal of elderly.
- There will be an increasing number of seniors living alone.
- Income deficiencies will be expected in the case of unattached or solitary seniors.
- Government policies are directed to encourage the independence of seniors in their own homes, with

the objective of physical delivery of social services to seniors.

- The trend will be to concentrations of seniors living in:
  - large metropolitan areas;
  - non-farm rural areas and small municipalities.
- Proportionately lower numbers will be found in ex-urban areas around metropolitan centres, and in regions of the mineral and resource extraction industry.
- Dispersion of seniors will occur to suburban areas of metropolitan centres and to farming regions.

Serious levels of isolation of seniors will be found in such areas.

Travel Behaviour

Seniors in general adopt a different lifestyle than persons in the working generation through loss of employment, family raising, education, etc. Other factors include the significant decrease in income (approximately 50% average income decrease), and increasing incidence of physical disability. Early elderly (65 to 75) will have distinctly different travel behaviour than will late elderly (75+) - more and longer trips, more work trips, greater use of autos.

It is expected that in the future non-seniors will make about 50% more trips than will seniors. Seniors' trips are made more frequently in the off-peak period and are oriented to a variety of medical, social and shopping trips. As with the remainder of the population, there is an emphasis on the use of automobile. As seniors get older, they become

more reliant on the walk mode.

An important factor in defining seniors' transport needs is the extent of unfulfilled travel needs which are expected to consist of social and recreational trips.

Anticipated changes in travel behaviour reflects changing life styles, and increasing income and health levels, leading in turn to more numerous and a wider variety of trips made.

Focus Groups

In the assessment of national needs for mobility and accessibility by seniors, six issue categories have been identified:

- the increasing incidence of transportation isolation;
- the implementation needs of a social service delivery policy;
- the increased use of public transit by ambulatory/ disabled seniors;
- the problems of elderly pedestrians;
- the need for cost-effecfive paratransit systems;
- the operation of motor vehicles by elderly drivers.

For the purpose of identifying research and development opportunities for seniors' transportation services, four critical categories of seniors have been identified. These are:

- transportation-isolated elderly;
- ambulatory-disabled elderly;
- late elderly;
- senior drivers.

Research and Development Proposals

On the basis of perceived accessibility needs of seniors

and the state-of-the-art of transportation technology in this area, a number of important research and development opportunities have been identified and listed below in the two categories of: technological concepts and technological systems.

Technological Concepts

- market and function of all-purpose paratransit vehicle;
- market and function of a mini passenger vehicle.
- senior-oriented design criteria for passenger transportation vehicles;
- scope of non-automotive type vehicles;
- technical aids for elderly pedestrians.

Technological Systems

- computerized paratransit services;
- conversion of paratransit operational programs to microcomputers;
- training and control of volunteer drivers;
- travel information centres.

Conclusions and Recommendations

The data sources examined and interpreted provide useful insights into the expected future behavior and needs of elderly travellers. It should, however, be noted that the above data sources are generalized in nature and were developed for purposes other than the subject assignment. There is a real need for definitive data on the numbers and distribution of seniors both at present and in the future, and their real and perceived transportation deficiencies.

The nine research and development opportunities listed above were evaluated in terms of:

- expected impact on segments of senior population (numbers of users);
- extent of benefits expected for user groups impacted;
- extent of potential opportunities for Canadian industry;
- likely ease of program implementation.

As a result of this evaluation, the following three categories of R&D opportunities were identified:

(i) Top priority is assigned to the following three initiatives which are judged as superior in the categories of: total number of seniors benefited, the degree of benefit expected and the extent of potential industrial opportunities:

- determine market and function of a purpose-built paratransit vehicle,
- determine market and function of a mini passenger vehicle,
- research and test vehicle design criteria for use of passenger transportation vehicles by handicapped seniors.

(ii) Second order priority is assigned to four opportunity categories which are judged superior in the areas of industrial potential and ease of implementation:

- development of scheduling programs for computerized paratransit operations,
- adaptation of paratransit operational programs to microcomputers,
- development of training and management procedures for volunteer drivers,
- assessment of potential scope for use of non-automotive passenger vehicles.

(iii) Third order priority is assigned to those categories whose advantages are confined to significant service benefits to users but which lack apparent potential for industrial opportunities:

- research and testing of technical aids for elderly pedestrians,
- develop travel information systems for use of passenger transportation services by seniors.

SOMMAIRE

Ce rapport récapitule les technologies permettant de répondre aux besoins et aux habitudes de transport des personnes âgées, pour les 40 prochaines années. L'étude, dont il fait le compte rendu, a effectué tour d'horizon du sujet qu'elle a relié à l'évolution prévisible des caractéristiques physiques, démographiques et socio-psychologiques des personnes âgées. Le résultat de cette étude en ce qui concerne le transport est repris ci-dessous:

Facteurs démographiques:

- La population des personnes âgées (ayant 65 ans et plus) passera de 2,362,000 en 1981 à 5,879,000 en l'an 2026, soit une augmentation de 150 p. cent.

- Au cours de cette période, la proportion de femmes en surnombre par rapport aux hommes passera de 38 à 46 p. cent.

- Au cours de cette même période, la proportion de personnes ayant plus de 75 ans passera de 59 à 65 p. cent par rapport aux personnes agées de 65 à 75 ans.

- Le nombre croissant de personnes ayant plus de 75 ans se traduira par un nombre plus élevé de personnes à mobilité réduite.

- On s'attend à ce que le nombre de personnes âgées possédant leur propre maison aille en augmentant, entraînant une dispersion géographique de ces personnes.

- Le nombre de personnes âgées vivant seules ira en augmentant.

- Le revenu des personnes âgées sans attaches ou vivant seules risque d'être insuffisant.

- Les politiques gouvernementales veulent encourager les personnes âgées à vivre indépendantes, quitte à leur fournir à domicile les services sociaux dont elles auront besoin.

- La tendance ira vers une concentration des personnes âgées:
  - dans les grandes agglomérations urbaines
  - dans les régions rurales non agricoles et dans les petites municipalités.

- Un nombre proportionnellement moins élevé se trouvera dans les régions autrefois urbaines ceinturant les métropoles, et dans les régions où se concentrent les industries extractives: richesses minérales, ressources diverses.

- La dispersion des personnes âgées se fera vers les banlieues et les régions agricoles.

Dans ces régions, le degré d'isolement des personnes âgées sera très élevé.

Habitudes de déplacement

De façon générale, les personnes âgées adoptent un style de vie différent de celui de la population active, les causes en étant la perte de l'emploi, l'absence de famille à élever, le faible niveau d'éducation, etc. Parmi les autres facteurs significatifs: la forte diminution du revenue (50 p. cent, en moyenne) et l'incidence croissante de handicaps physiques. Le groupe des personnes dont l'âge se situe entre 65 et 75 ans aura des habitudes de déplacement bien différentes de celles du groupe ayant plus de 75 ans: déplacements plus longs et plus nombreux, destinations travail en nombre plus grand, utilisation plus fréquente de véhicules automobiles.

Il est prévu que le groupe de personnes âgées effectuera 50 p. cent moins de déplacements, par rapport au restant de la population, ces déplacements se faisant plus fréquents dans les heures creuses et pour des motifs divers: médicaux, sociaux et magasinage. A l'instar du restant de la population, l'accent sera mis sur les déplacements en automobiles; mais, à mesure que ce groupe veillira, il optera de plus en plus pour la marche.

Un facteur important à prendre en compte dans la définition des besoins de transport ressentis par les personnes âgées est la demande de transport restant à satisfaire et dont les motivations sont largement sociales et récréatives.

Les changement prévisibles dans les habitudes de déplacement sont la conséquence des changements dans le style de vie des personnes visées et d'un relèvement dans leur revenue et leur état de santé; il en résultera des déplacements plus nombreux pour des motifs plus variés.

Population étudiée

L'evaluation de la demande des personnes âgées pour une mobilité occrue et une plus grande accessibilité aux transports a mis en lumière six facteurs à prendre en compte:

- l'incidence croissante de l'isolement des personnes visées du point de vue des transports;
- les exigences d'une politique visant à fournir à domicile les services sociaux des personnes âgées;
- l'utilisation de plus en plus fréquente des transports collectifs par les personnes âgées, à mobilité normale ou réduite;
- les problèmes ressentis par les piétons âgés;
- le coût des transports semi-collectifs;
- l'utilisation de l'automobile par les personnes âgées.

Dans le but trouver des sujets intéressant la recherche et le développement en matière de transport des personnes âgées, ces dernières ont été considérées sous quatre aspects différents, à savoir:

- l'isolement du point de vue des transports;
- la mobilité: normale ou réduite;
- l'âge: moins que 75 ans ou plus;
- l'utilisation d'une automobile ou non.

Propositions de recherche et de développement

A partir des besoins perçus, et compte tenu des connaissances acquises dans le domaine du transport des personnes âgées, d'importants concepts ont été dégagés. Ils forment deux groups distincts selon qu'ils intéressent les matériels de transport ou les systèmes d'exploitation.

Recherche touchant les matériels de transport

1) marché et utilité d'un véhicule tout usage de transport semi-collectif;
2) marché et utilité d'une mini voiture;
3) adaptation des véhicules de transport aux besoins des personnes âgées;
4) Domain d'application de véhicules non automobiles;
5) Aides technologiques aux piétons âgés.

Recherche touchant systèmes d'exploitation

6) régulation des transports semi-collectifs assistés par ordinateur;
7) informatisation des méthodes d'exploitation du transport semi-collectif;
8) formation et direction des conducteurs bénévoles;
9) systèmes d'information sur les transports adaptés aux personnes âgées.

Conclusions et recommandations

La documentation consultée et l'interprétation qui en a été faite ont jeté un éclairage précieux sur la demande future en transport des personnes âgées et sur leurs habitudes de déplacement prévisibles. Il faut toutefois préciser que cette documentation avait une portée générale et qu'elle ne concernait pas particulièrement la population visée par cette étude. Il existe donc un besoin réel pour des données fiables

sur la population des personnes âgées, quant à leur nombre et leur distribution, aujourd'hui et dans les années à venir, et sur les lacunes réelles ou perçues dont elle se ressent en matière de transport.

Les neuf concepts dont il a été question ci-dessus ont été évalués en fonction:

- du nombre total de personnes âgées qui pourront en profiter;
- de l'étendue des avantages escomptés qu'elles en tireront;
- des retombées eventuelles pour l'industrie du pays;
- de la facilité de mise en oeuvre.

Enfin, ces neuf concepts ont été répartis en trois groupes, selon l'ordre des priorités, commes suit:

(i) Priorité élevée: il s'agit des actions susceptibles de profiter au plus grand nombre, d'avoir un domaine d'application plus étendu et d'avoir le plus de retombées pour l'industrie. Ce sont celles qui ont le numéro 1, 2, et 3.

(ii) Priorité moyenne: ce sont les actions numérotées 6, 7, 8 et 4 qui promettent beaucoup pour l'industrie et qui sont plus vaciles à mettre en oeuvre.

(iii) Priorité basse: ce sont les actions numérotées 5 et 9 dont l'utilité pourrait être importante, mais dont l'intérêt industriel est apparemment restreint.

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1.0 INTRODUCTION

As outlined in the Work Statement prepared by the Transportation Development Centre (TDC), TDC's technological program for the mobility disadvantaged in the past has not specifically addressed the needs of the elderly population. Such an investigation is seen as timely in light of such upcoming activities as the Year of the Elderly to be held in the mid 80's, and the Third International Conference on Mobility and Transport of Elderly and Handicapped Persons in 1984. Accordingly, a project on Elderly Transportation Technology was implemented.

Objective. To improve the access and safety of transportation systems for the transportation disadvantaged. The study is to deal with the types of technology suitable for the transportation needs and habits of the elderly in accordance with their projected numbers up to the year 2025, and their physical, demographic, and social/psychological characteristics.

Because of time and resource constraints the intent of the project was to confine investigation to existing sources and research documentation. Accordingly, a large part of study activity consisted of literature search and interviews with suitable authorities in the field.

An initial step was the preparation of a work plan which outlined a sequence of two major steps:

1. Review of Demographic Characteristics and Travel Behaviour.
2. Identify Technological Requirements and Research and Development Opportunities.

Some of the important study outputs consist of:

- present and future demographic characteristics;

- critical social/economic issues related to transportation needs;
- overall patterns of present and future travel behaviour;
- major accessibility and mobility needs or issues;
- identification of relevant focus groups of seniors in terms of critical transportation issues;
- quantification and discussion of these in terms of socio/psychological and demographic characteristics;
- identification of technological concepts and opportunities in relation to the relevant focus groups;
- evaluation of such opportunities in terms of user effects, implementation factors and industrial opportunities;
- identification of priorities of research and development opportunities.

2. DEMOGRAPHIC CHARACTERISTICS OF ELDERLY IN CANADA: 1981 TO 2026

2.1 Overall Status of Elderly in Canada

A recent report by the Government of Canada - "The Canadian Government Report on Aging"[1] interprets the results of the 1981 census and other sources in reviewing the current and changing status of senior citizens in Canada. This report deals with the following subjects:

2.1.1 Income - Unattached seniors suffer from low income status, i.e. 1979 data indicates that 42% of unattached women and 33% of unattached men have incomes below the low-income cutoff level. As a result of prevailing conditions for working women, lower pensions and resulting incomes are expected in future. The older elderly categories (75+ years) suffer from more severe income deficiencies than the younger elderly (65-75 years).

2.1.2 Labour/Employment - 1981 census data indicates participation rates for seniors of 14.4% for the 65-69 age group, falling to 5.2% for the 70+ group, and a combined participation rate of 8.6% for all seniors (65+). This compares to a total population rate of 64.7%. Aging women have about one-third the participation rate of men.

Trends indicate a falling participation rate for senior men and a rising rate for senior women. It can be expected that more senior women will be working in the future than at present.

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[1] All references in Section 2.1 are from: Canadian Governmental Report on Aging. Department of National Health and Welfare, Ottawa, Ontario, June, 1982.

An analysis of categories of employment indicates that the bulk of elderly employed occurs in the following categories:

. Industrial - agriculture, trade, and service;
  Professional - managerial, service, processing and primary industries.

This reflects the propensity of senior employment in the areas of self-employment. This includes those who continue to work by choice (professionals, tradesmen, farmers) and those who work to supplement income (women and low income service personnel).

A trend is indicated to earlier retirement by men, with possible shifts to other and less formal forms of employment, plus a likely increase in working elderly associated with the use of personal autos.

Data indicates a decline in physical capabilities occurring around age of 75, explaining rapid decline in rate of employment participation and auto use after age of 75.

2.1.3 Health - 80% of elderly functionally capable of living independently and caring for themselves. Between 1950 and 1978 the health problems of persons over 65 increased by over 50%. This reflects the higher survival rate and resulting larger proportion of the population in the older age groups. It also indicates the higher demand for health services from the senior age bracket.

Problem of geographic differentiation of both quality and accessibility to health services:

Quality - differs between provinces, and a decline from larger urban centres to small urban and rural communities.

Accessibility - problems in access to health care occur in rural and remote areas. In the

latter case, transport is mainly by air. Accordingly, a service deficiency can be expected in the case of seniors in rural areas requiring access to health services.

Current official thinking indicates a policy stressing the provision of home services to seniors. This results in significant implications for delivery of services to seniors in both suburban and rural areas, and, as well, consideration of the role of voluntary agencies.

2.1.4 Housing and Environment - Home ownership among seniors exceeds that of rest of population, i.e. 1976 - 2/3 of senior households owned or occupied houses (only 10% with mortgages). Less than one-third seniors rent (mainly apartments) - women renters constitute twice men renters.

Car ownership: (1976)	total Canadian households	- 75%
	seniors (married)	- 60%
	seniors (unattached)	- 18%
	seniors (rural)	- 25%
	seniors (urban)	- 75%

Housing Demand - Anticipate seniors' demand for housing to increase at rate 30-40% greater than rate of increase of seniors' population, reflecting seniors' desire for separate dwelling quarters. A current municipal issue involves the choice of integrated versus segregated senior housing.

Transportation Issues:

- urban areas - suburban isolation a problem, paratransit not a consistent solution
- rural areas - most serious problem - isolated, less visible, lower incomes - generally no transit available
- social service delivery - major transportation problem

- cooperation of public and private sectors needed;
- transportation key to success of social programs (e.g. education, culture, recreation, health, housing)

2.1.5 The Family

- seniors' household pattern (65+)
  - 66% - share home with kin
  - 4% - share home with unrelated persons
  - 22% - live alone
  - 8% - in collective household (institutions, etc.)

Pension program has stimulated living alone:
i.e. (from 1961 to 1976):
- men living alone increased from 10 to 12%
- women living alone increased from 15 to 29%

Most institutionalized persons are over 80 years of age.

Stress two generations of seniors:
- early elderly - 65 - 74 years of age
- late elderly - 75+ years of age

"Early" elderly, highly active, independent.
"Late" elderly, distinct change to less activity, etc.

Couples: (1976)	Men (% Married)	Women (% Married)
65 to 69	82	56
80+	53	15
65+	74	39

Female Population - Projected Marital Status ('000)

Year	Total Single	Total Married	Widowed				Grand Total
			65-74	75-84	85+	Total	
1980	125 (10%)	517 (40)	293 (23)	248 (20)	88 (17)	629 (49)	1271 (100)
2000	143 (7%)	889 (46)	339 (17)	408 (21)	166 (9)	913 (47)	1944 (100

Seniors' basic goal - independence, i.e. not to be "dependent". Independence for seniors is achieved by security made possible by 24-hour support systems.

2.1.6 Social Welfare

Goals of social services:

- help older persons to live in own homes for as long as possible,
- provide care and protection away from home when required.

Mechanisms:
- home care and support systems;
- senior centres (drop-in to multi-purpose centres);
- adult day care;
- institutional care.

The issue exists of Community Care versus Institutionalized Care. The report stresses community care services as an opportunity for older seniors to assume responsibilities, exercise rights and choices, and to participate in community life. The transportation implications of a community care policy indicate an enhanced role of voluntary agencies - a measure that has not been highly successful to date.

2.1.7 Developmental Issues

A number of key issues concerning the future needs of seniors are closely related to transportation services, i.e.:

- the critical need for rural accessibility,
- the problem of suburban isolation;
- the policy to provide community or home services;
- the goal of seniors to live in own homes;
- the opportunities for seniors to participate in transport services, social service delivery, etc.

Opinions of specialists in seniors' programs indicate that:

- "late" elderly tend to move from private homes into institutions or more central apartments, etc.,
- "early" elderly are more self sufficient and remain in

homes,

- serious logistical and economic problems expected in delivery of social services to seniors' homes,
- service delivery problems call for consolidation of services (i.e. concentration of staff close to seniors - shopping centres, hospitals, community centres) plus integration of transportation.

2.2 Basic Demographic Statistics and Forecasts

2.2.1 Current and Forecast Elderly Population

Existing Statistics (1981)[1]

Total population (national)	24,343,000	
Total male population	12,068,000	
Total female population	12,275,000	
Over 65 Years of Age		**(% of Group Total)**
total (national)	2,362,000	(9.7%)[2]
total male	1,011,000	(8.4%)[3]
total female	1,350,000	(11.0%)[4]
65 to 75 Years of Age		
total (national)	1,477,000	(6.1%)
total male	672,000	(5.6%)
total female	806,000	(6.6%)
75 and Over Years of Age		
total (national)	885,000	(3.6%)
total male	339,000	(2.8%)
total female	544,000	(4.4%)

. **Forecasts**

a) **Year 2001**

(i.e. extrapolation of 1981 census data according to Statistics Canada. Catalogue 91-520; "Population Projections for Canada and the Provinces".)

Total population (national)	30,702,000	
Total male population	15,153,000	
Total female population	15,549,000	
Over 65 Years of Age		**(% of Group Total)**
total (national)	3,439,000	(11.2%)[2]
total male	1,364,000	(9.0%)[3]
total female	2,068,000	(13.3%)[4]

---

[1] Age, Sex and Marital Status, Catalogue No. 92-901 Volume I: National Series, 1981 Census of Canada, Statistics Canada.

[2] Percent of total population.

[3] Percent of total male population.

[4] Percent of total female population.

65 to 75 Years of Age		
total (national)	1,909,000	(6.2%)
total male	846,000	(5.6%)
total female	1,063,000	(6.8%)
Over 75 Years of Age		
total (national)	1,522,000	(5.0%)
total male	525,000	(3.5%)
total female	997,000	(6.4%)

b) Year 2026

(i.e. extrapolation of 1981 census data according to Statistics Canada Catalogue 91-520 "Population Projections for Canada and the Provinces")

Total population (national)	36,714,000	
Total male population	17,995,000	
Total female population	18,719,000	
Over 65 Years of Age		(% of Group Total)
total (national)	5,879,000	(16%)[1]
total male	2,388,000	(13.2%)[2]
total female	3,491,000	(18.6%)[3]
65 to 75 Years of Age		
total (national)	3,574,000	(9.7%)
total male	1,583,000	(8.8%)
total female	1,991,000	(10.6%)
Over 75 Years of Age		
total (national)	2,305,000	(6.3%)
total male	805,000	(4.4%)
total female	1,500,000	(8%)

2.2.2 Degrees of Physical Disability

A main source of information on quantification of transportation handicapped persons in Canada is the Data Base Study for the Identification and Quantification of Transportation Handicapped (TH) in Canada, undertaken in 1979. The following tabulated data is taken from that source.

---

[1]Percent of total population.
[2]Percent of male population.
[3]Percent of female population.

(It should be noted that the above study represented an extrapolation of a U.S. survey to Canadian parameters. The results have been found to be imprecise in certain categories).

Canadian Handicapped Population (1976 Data)

i) Percentage of Canadian TH Population

age group	percentage	number
65 - 69	11%	85,927
70 - 79	20%	156,232
80+	10%	78,116
Total	41%	320,275

ii) Percentage of Canadian Population[1]

age group	percentage
65 - 79	0.5%
70 - 79	1.0%
80+	0.5%
Total	2.0%

iii) Percentage of TH People by Age Group (Populations)

age group	percentage
65 - 69	15.8%
70 - 79	25.0%
80+	34.0%

iv) Percentage of TH Persons by Dysfunction Group

Dysfunction Group	% of Total TH Population[2]
wheelchair	5.6%
mechanical aid	24.4%
visual	21.2%
hearing	21.0%
minor	46.3%

---

[1]Target population covered persons five years or older, living in urban areas, and living in private households - i.e. 15,709,175 persons.

[2]Amounts total more than 100% as a result of individuals possessing more than one disability.

v) Degree of Difficulty TH People Have in Using Public Transportation

	% of TH Population
Some Difficulty	52%
A Lot of Difficulty	29%
Unable to use	19%

2.2.3 Economic Factors

i) Income - Economic Families[1]
(1977 data - 1978 constant dollars)

. All age groups of family head	
male family head	$21,000
female family head	11,000
Family head 65 and over	$12,000
Family head aged 65 - 69	12,000
Family head aged 70 and over	8,500

ii) Income - Unattached Individuals
(1977 data - 1978 constant dollars)

. All age groups of unattached individuals	
male	$9,000
female	6,000
. Unattached persons 65 and over	
male	$4,500
female	4,100
. Unattached persons 65 - 69	
male	$4,500
female	4,100
. Unattached persons 70 and over	
male	$3,800
female	3,700

[1] "Aspects of Population Aging in Canada - A Chartbook" - L.O. Stone & S. Fletcher, Statistics Canada, 1981.

. % of Old Age Security Pensioners Receiving Full and Partial Guaranteed Income Supplement (GIS) 1975-76[1]

with full GIS	24.1%
with partial GIS	31.1%
without GIS	44.8%

. Average Income of Families, Unattached Individuals and All Family Units 1969 and 1975[1]

	1969	1975
families, head, all ages	$8,900	$16,600
families, head, 65+	5,500	10,200
unattached individuals, all ages	4,000	6,600
unattached individuals, 65+	2,500	4,100
all family units, heads, all ages	7,700	13,800
all family units, heads, 65+	4,200	7,500

iii) Housing

% of Private Housing, Owning Own Dwelling by Household Heads (1976 data)

Age 25 - 64	
male	70%
female	38%
Age 65 and over	
male	92%
female	50%

. Type of Private Dwelling Occupied by All Household Heads and Those 65+, Canada, 1976[1]

dwelling type	total household heads	household heads 65+
single detached	55.7%	57.1%
single attached	8.2	5.4
apartment	28.7	31.3
duplex	4.9	4.9
movable	2.4	1.4

---

[1] "Canada's Elderly", Catalogue 98-800E, Statistics Canada, 1979.

iv) Auto Ownership

% of One-Family and One-Person Households with Automobile(s) (1977 data)

all ages	46%
65 and over	27%

% of Households with Automobile(s) (1971 data)

25 - 64	83%
65 and over	51%
65 - 69	63%
70 and over	43%

v) Life Style Groups

These are to be considered in terms of those elderly persons who:
- are transportation handicapped
- use cars
- do not have access to cars

In broad terms, based upon national statistics, the following statistics are available (1981 65+ population)[1]

	%	Number
Transportation Handicapped	2.4%	47,200
Access to Cars	50%	1,181,000
Carless	48%	1,133,800
Total		2,362,000

---

[1] Data Base Study for the Identification and Quantification of Transportation Handicapped Persons in Canada. Transport Canada 1979, plus an interpretation of vehicle use data carried out in Transportation for the Elderly Study, Ontario Ministry of Municipal Affairs and Housing, 1982.

2.3 Locational and Related Information

The goal in this phase of the study is to identify locational and migratory trends in the dispersion of seniors in the different national geographic designations in the country. This will provide some evidence as to the seriousness of possible isolation conditions, in order to support the priorizing of transportation initiatives and programs. This subject will be dealt with in terms of the following categories:

- national, interprovincial patterns;
- intra-provincial, regional patterns;
- urban/local patterns;

2.3.1 . National, Interprovincial Patterns

As recorded by Statistics Canada according to the national census held in 1976 and 1981, the proportion of total population over 65 years of age were:

1976: 8.7%
1981: 9.7%

Charts 1 to 5 are attached, which illustrate national distribution patterns.[1]

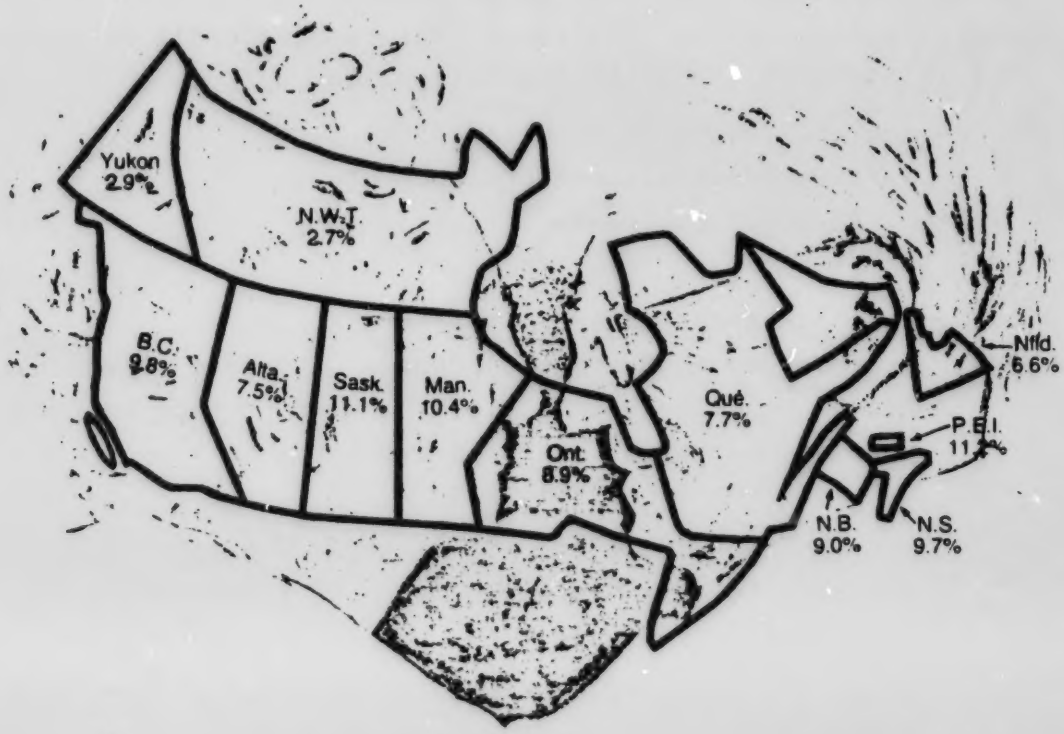
Chart 1 - Percentage of Provincial Population 65 and Over, 1976. This shows provincial levels ranging from 6.6% in Newfoundland to 11.2% in Nova Scotia, with Newfoundland, Alberta and Quebec having elderly levels below the national average of 8.7%.

Chart 2 - Percentage Distribution of Total Population and Population 65+ by Province, 1976. The extremes of elderly distribution are represented by Newfoundland at the low end and Manitoba at the high end.

[1] Charts 1 and 2. Source Cat. 98-800E, Statistics Canada. Canada's Elderly.
Charts 3, 4 and 5. Source Aspects of Population Aging in Canada. A Chartbook. Statistics Canada, National Advisory Council on Aging, June, 1981.

Chart No. 1

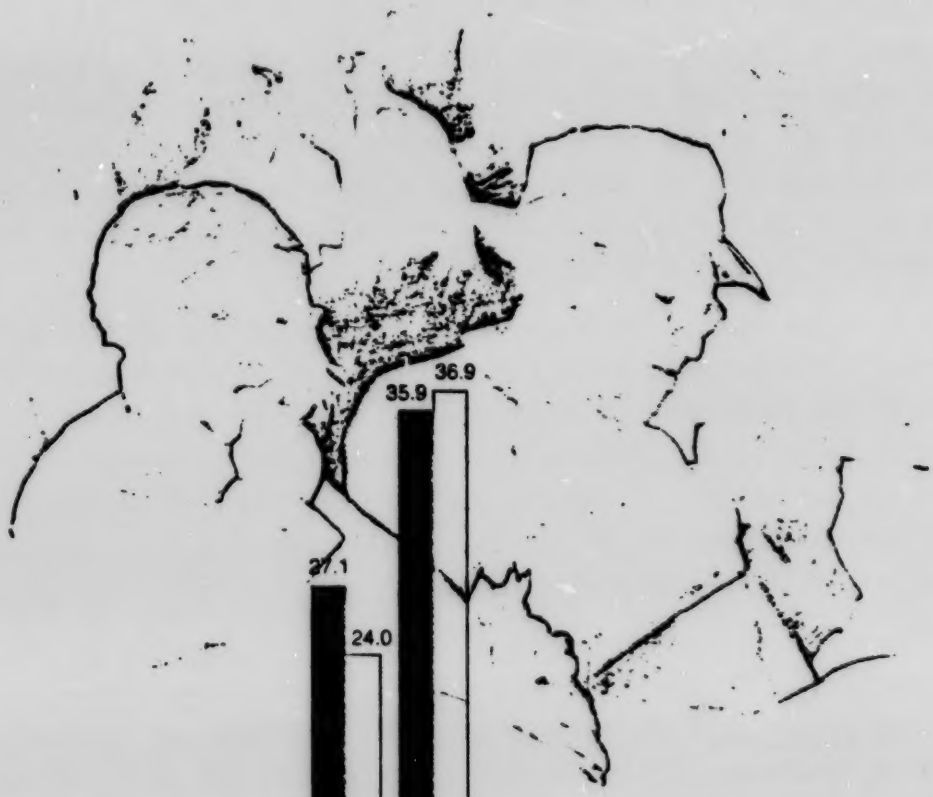
Percentage of Provincial Population 65 and Over, 1976

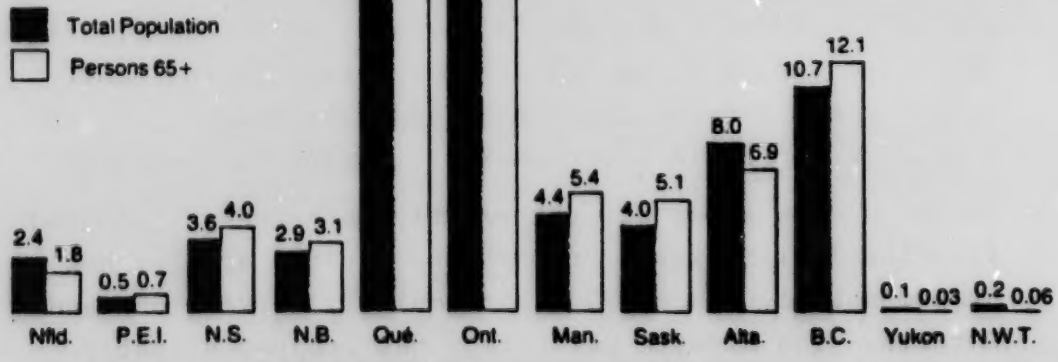


Source: 1976 Census of Canada, Catalogue 92-823, Table 11.

Chart No. 2

Percentage Distribution of Total Population and Population 65+ by Province, 1976





Source: 1976 Census of Canada, Catalogue 92-823, Table 11.

Chart 3 - Percentage of the Population Aged 65 and Over, Canada and Provinces, 1901 to 1976. This chart illustrates the shift to higher percentages, particularly in the prairie provinces, with a lag in the 50's resulting from the baby boom, and the disposition of Ontario and Quebec above and below the national average.

Chart 4 - Provincial and Rural-urban Distributions of the Population Aged 65 and Over, Canada, 1976. The upper chart shows the actual numbers of seniors as distributed in the provinces - i.e. over one-third in Ontario, over 60% in Ontario and Quebec and about 3/4 in Ontario, Quebec, and British Columbia combined.

The lower chart shows the high numbers found in cities (50% in cities of over 100,000 population), explaining the preponderance of seniors in the three urbanized provinces of Ontario, Quebec and British Columbia. A striking statistic is the almost one-third of seniors found in the under 10,000-urban-centres and the rural, non-farm categories combined.

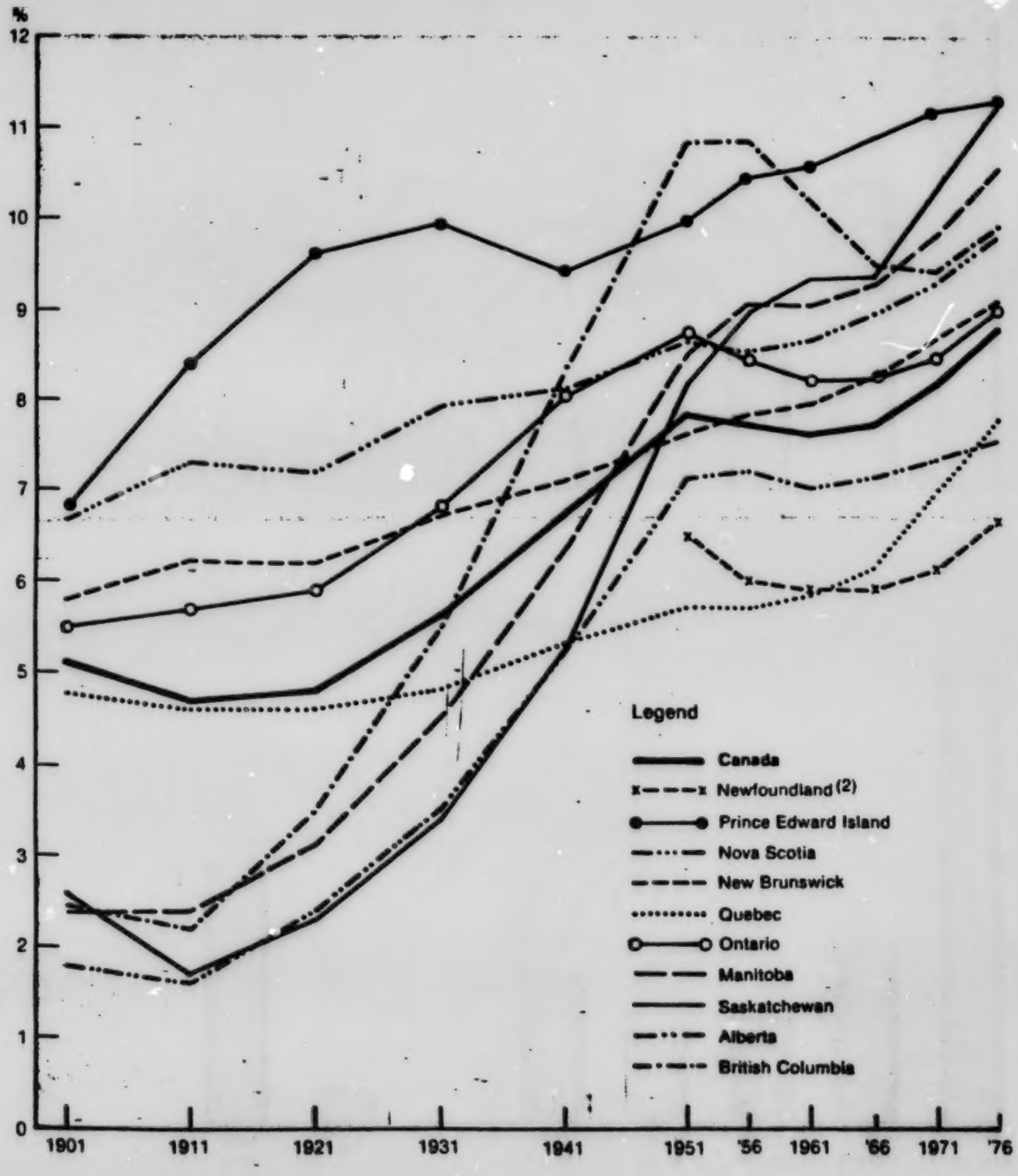
Chart 5 - Percentage Aged 65 and Over of the Total Population by Residence in Urban Size Groups, Rural Farm and Rural Non-farm Areas, Canada, 1961 to 1976. This chart shows the changing percentage patterns in the seven generalized urban and rural categories between 1961 and 1976. Of note are the fairly uniform levels of larger urban centres, and, as well, the increase in the under 10,000 urban and the rural non-farm categories, plus the significant drop in the number of seniors on the farm.

Table I below shows current elderly patterns as produced from the 1981 Census. Proportion of total seniors has jumped sharply since 1976, particularly in Manitoba and Ontario. The Alberta percentage has dropped slightly.

Chart No. 3

Chart — 31

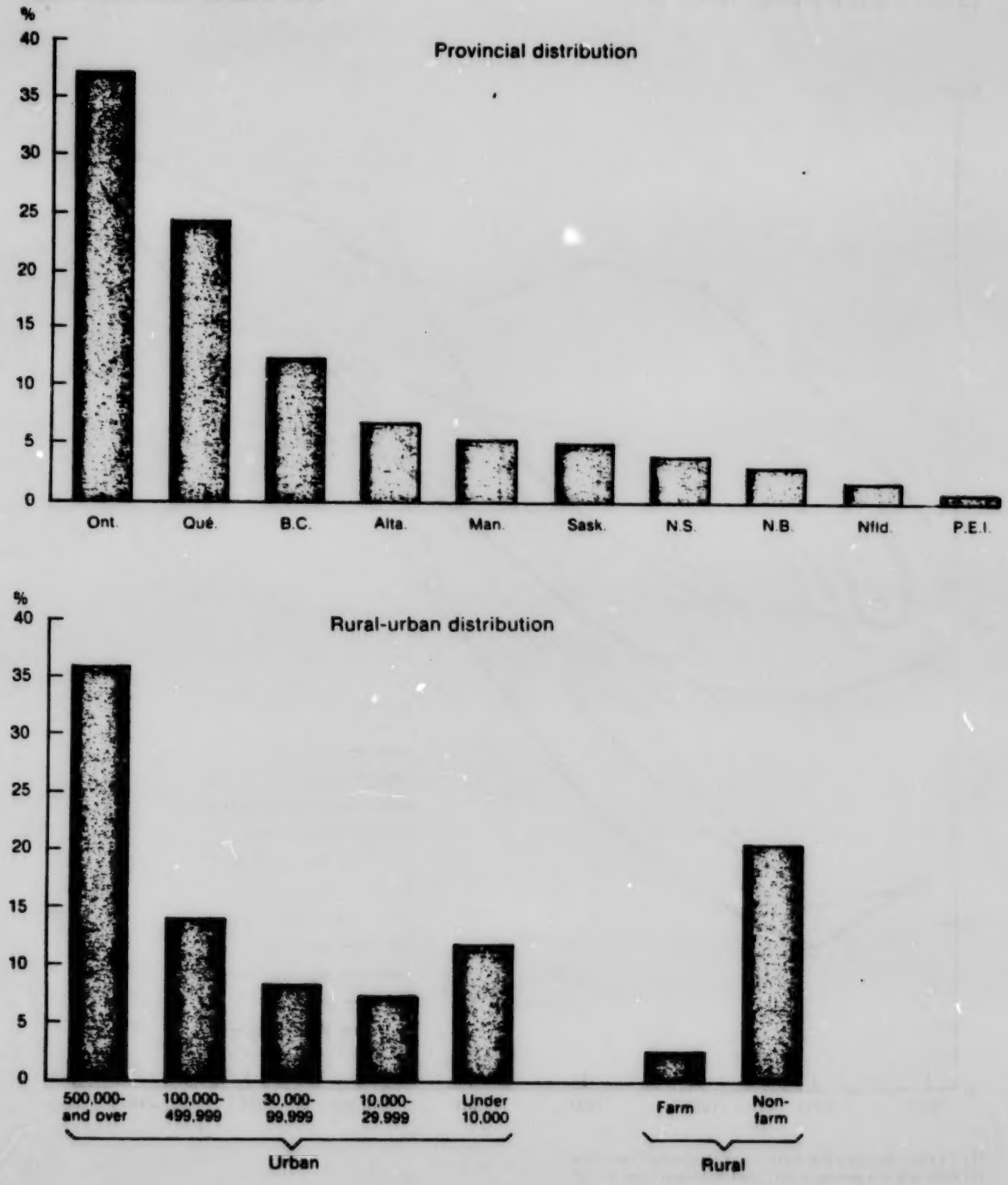
Percentage of the Population Aged 65 and Over, Canada (1) and Provinces, 1901 to 1976



(1) Canada includes the Yukon and Northwest Territories.
(2) Data are not available for Newfoundland prior to 1951.
Source: Statistics Canada, Census.

Chart No. 4

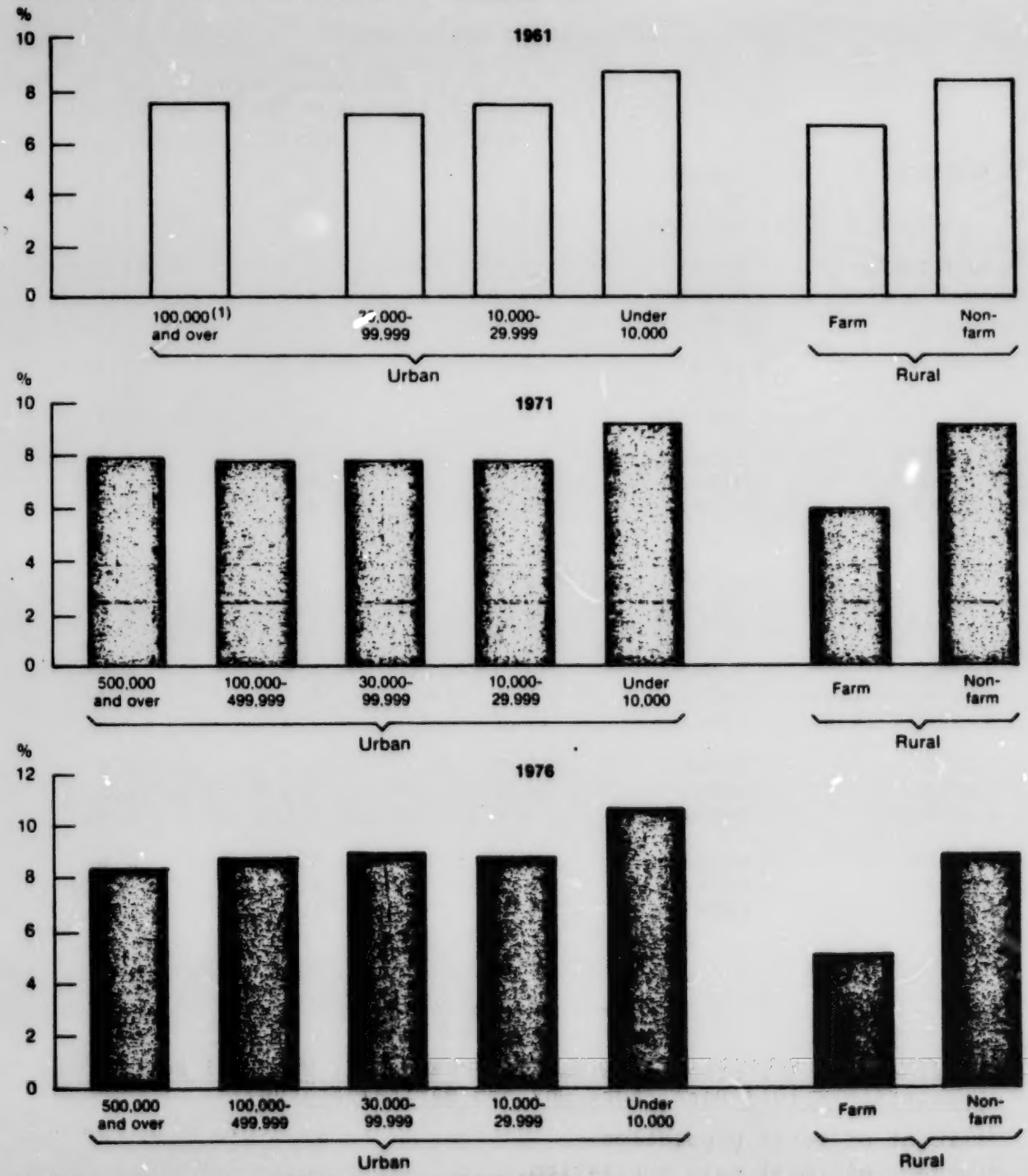
Chart — 33
Provincial and Rural-urban Distributions of the Population Aged 65 and Over, Canada, 1976



Source: Statistics Canada, Census.

Chart No. 5

Chart — 32
Percentage Aged 65 and Over in the Total Population by Residence in Urban Size Groups, Rural Farm and Rural Non-farm Areas, Canada, 1961 to 1976



(1) Data for the urban size groups 500,000 and over and 100,000-499,999 were not published in 1961.
Source: Statistics Canada, Census.

Table I

1981 - Basic Demography[1]

		Age Groupings (% of total population by group)		
		65+	65-75	75+
CANADA	total	9.7%[2]	6.1%	3.6%
	males	8.4 [3]	5.6	2.8
	females	11.0 [4]	6.6	4.4
MANITOBA	total	12.0	7.2	4.8
	males	10.7	6.9	3.7
	females	13.1	7.5	5.6
ONTARIO	total	11.2	6.2	3.8
	males	8.5	5.7	2.8
	females	11.5	6.7	4.8
ALBERTA	total	7.3	4.5	2.8
	males	6.8	4.3	2.5
	females	8.1	4.8	3.3
CANADA urban centres 500,000+	total	9.4	5.9	3.5
	males	7.6	5.1	2.5
	females	11.1	6.6	4.5
CANADA urban centres 5,000-10,000	total	11.0	6.4	4.5
	males	9.4	5.9	3.4
	females	12.7	7.2	5.5
CANADA rural non-farm	total	12.0	9.3	9.7
	males	6.2)	6.3)	6.2)
	females	5.9)	3.0)	3.6)
CANADA rural farm	total	5.4	6.1	4.8
	males	3.9)	4.6)	3.1)
	females	1.4)	1.4)	1.7)

---

[1] Catalogue 92-901 Statistics Canada. Volume I: National Series. Population - 100% Data, Age, Sex and Marital Status.

[2] Percent of total population.

[3] Percent of total male population.

[4] Percent of total female population.

In the case of urban/rural categories, sharp increases have occurred in percentages of elderly in rural/non-farm (+33%), urban, under 10,000 (+23%) and urban, over 500,000 (+15%).[1]

Interesting patterns occur in the male/female split categories.

- Much higher proportions of elderly females than males in the large urban categories (centres 500,000+) - i.e. 46% more females 65+, 80% more females 75+. Higher disparity of senior female/male proportions in all urban categories.
- Equality of elderly males and females in all rural categories. In the case of rural/farm category - 27% more males 65+ than females, 17% more females 75+ than males.

Comment. Since evidence seems to indicate that couples seem to cope better than single seniors, it can be expected that there will be a higher proportion of couples on farms with resulting living advantages.

2.3.2 Intraprovincial, Regional Patterns

In the October, November and December, 1981, editions of the Demographic Bulletin published by the Government of Ontario, a three-part report was included on the Population Aged 65 and Over in Ontario. Figures 1 and 2 are attached and are reproduced from the above report. These depict the intensity patterns by county and regional municipalities of their proportion of seniors. General information on aging in Ontario indicates the following trends:

Numbers of Seniors. Percentage of total population over 65 years of age has increased from 8.1% in 1961 to 8.9% in 1976 in Ontario. The combined populations of the seven largest urban areas in Ontario in 1976 have included over 50% of the seniors in Ontario, indicating that about 50% of seniors lived outside of these centres. The proportion of provincial seniors living in Metropolitan Toronto has remained the same at about 26%, which indicates that

[1]Comparisons available from data on Chart No. 5 and Table I above.

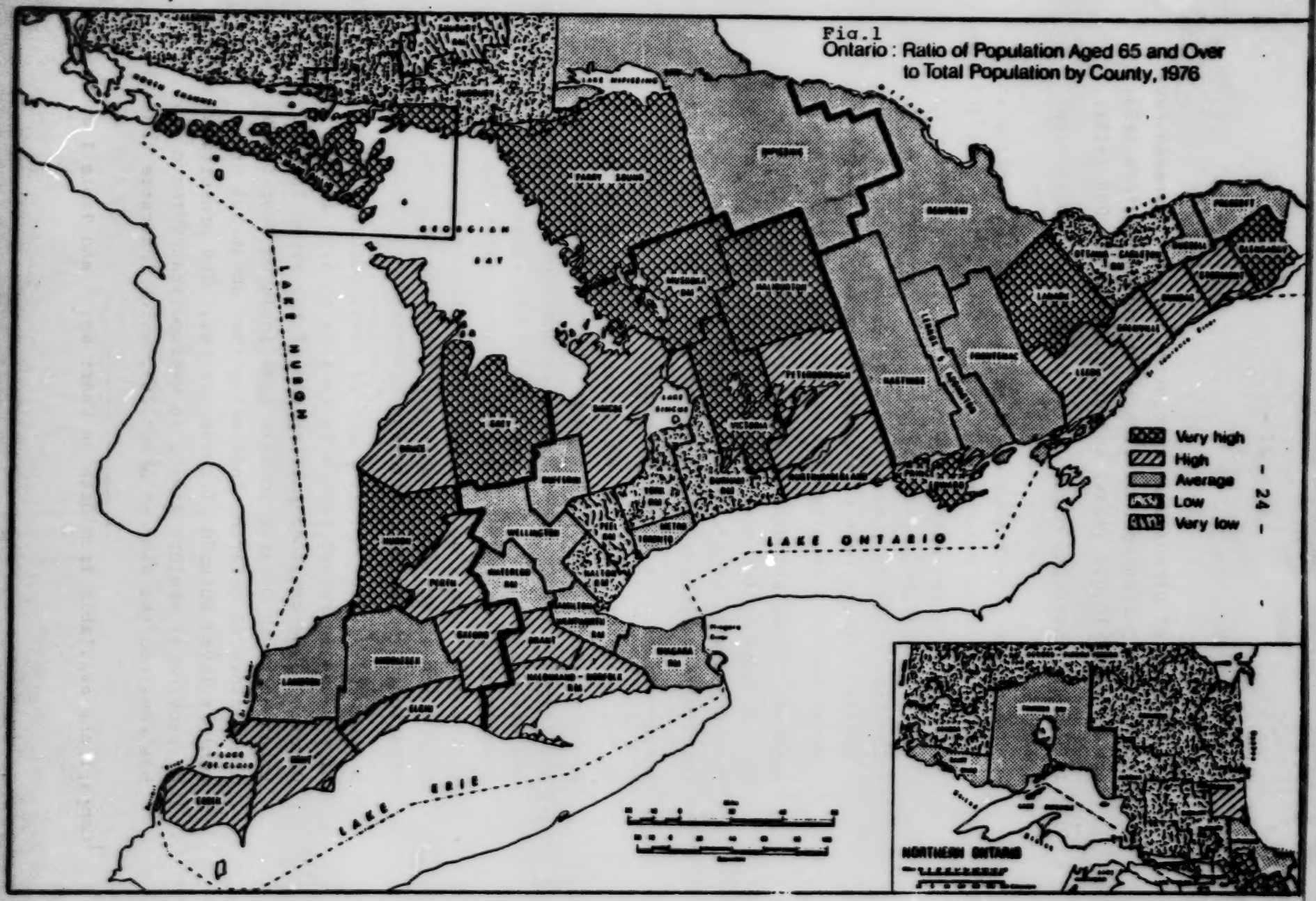


Fig.1
Ontario : Ratio of Population Aged 65 and Over to Total Population by County, 1976

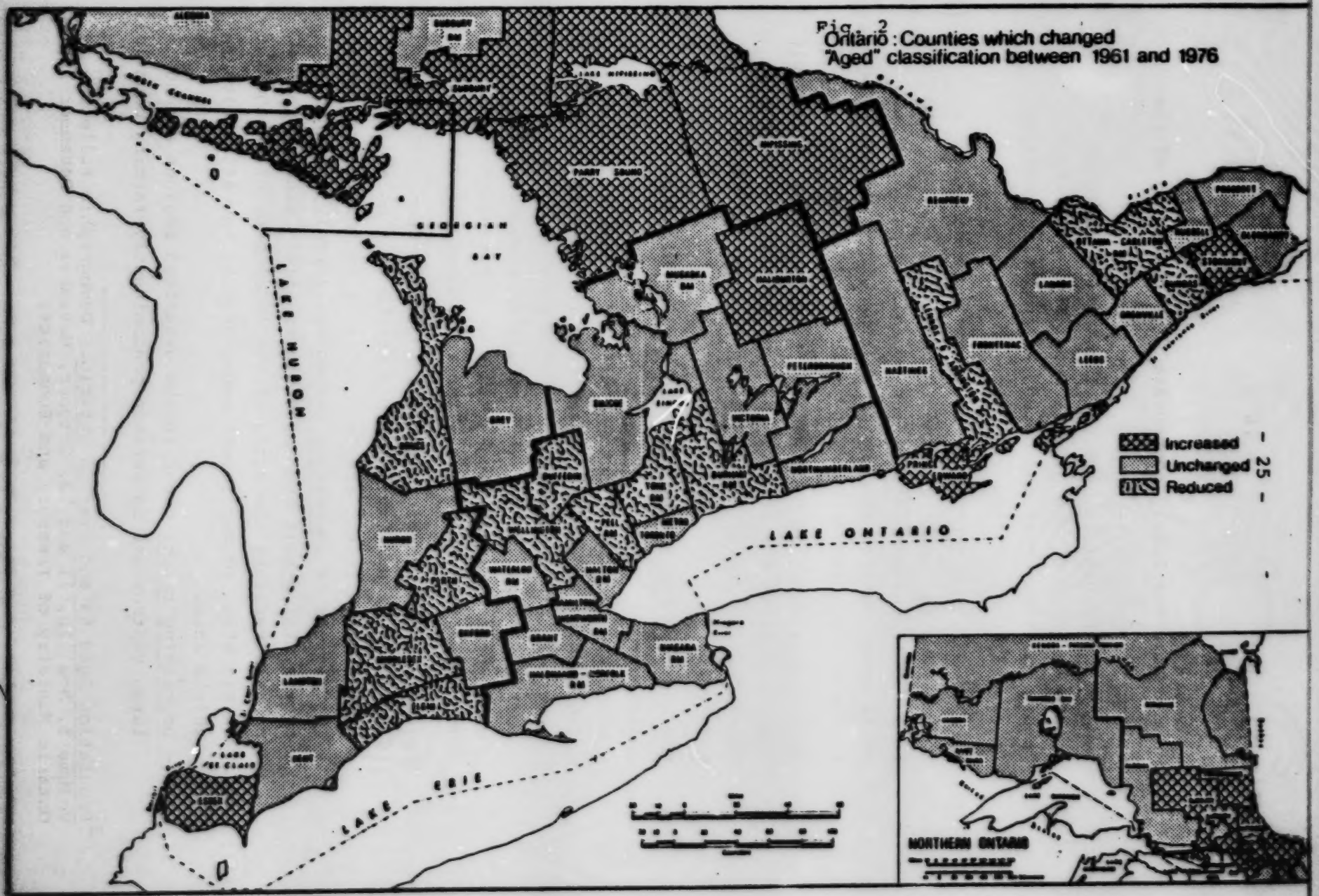


Fig. 2
Ontario : Counties which changed
"Aged" classification between 1961 and 1976
Increased
Unchanged
Reduced
LAKE HURON
LAKE ONTARIO
LAKE ERIE
NORTHERN ONTARIO

in-migration has likely compensated for the aging of the population.[1]

Proportion of Seniors. Figure 1 shows the ratio of population Aged 65 and Over to Total Population by County in 1976. This indicates the following tendency to elderly concentrations:

Very High ratios tend to occur in areas of combined tourism and low grade farming economy. This would seem to indicate the combined effect of aging population in small urban centres and the occupation of retirement homes in these areas, in influencing senior concentrations.

High ratios exist in high density farming areas. This would seem to reflect the concentration of elderly in the rural non-farm (i.e. retirement) and the small urban centre categories.

Low and Very Low ratios occur in the two geographic categories of:

- urbanized regions in the vicinity of Ottawa and Toronto (reflecting preponderance of young families in these metropolitan fringe suburbs).
- northern communities with a mining or resource extraction base (perhaps indicating a tendency for seniors to emigrate from these areas for retirement purposes).

Figure 2 shows changing trends in aging between 1961 and 1976. This is a relatively long period of time and likely represents consistent trends. Patterns indicated are that:

- The regions of increasing ratios are largely confined to the mining belt and the southern shield areas. This perhaps reflects the aging of the local population and the in-migration to retirement residences in the attractive shield areas.
- Decreasing ratios occur in the urbanized regions around large centres and in certain predominantly farming counties.

---

[1] Population Aged 65 and Over in Ontario. Demographic Bulletin, Volume 5, Nos. 10, 11 and 12, October, November and December 1981, Ontario Ministry of Treasury and Economics.

A general conclusion to be drawn from the above is the apparent concentration of seniors in rural areas and the likely problems resulting from isolation and the accessibility needs of seniors in these areas.

2.3.3 Urban-Local Patterns

In a book recently published dealing with transportation and the disadvantaged[1], the following table depicts the distribution of U.S. elderly population.

Distribution of Elderly 65+ (U.S.A. 1970)

location	total	handicapped	%
central city	6,600,000	1,300,000	33
suburban	5,800,000	1,200,000	30
rural	7,600,000	1,500,000	37
Total	20,000,000	4,000,000	100

As shown above on Chart No. 4, the distribution of seniors in Canada by geographic category in 1976 is listed as follows:

		% of total seniors (65+)	
Rural	non-farm	20%	
	farm	3%	
	total		23%
Urban	less than 10,000	12%	
	10,000 to 30,000	7%	
	30,000 to 100,000	8%	
	100,000 to 500,000	14%	
	greater than 500,000	36%	
	total		77%

An unpublished paper recently prepared dealing with a study of seniors in southern Ontario[2] provided some information on the present and future distribution of seniors in urban

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[1] Transportation and the Disadvantaged (The Poor, the Young, the Elderly, the Handicapped). John J. Falcocchio, Edmund J. Cantilli, Polytechnic Institute of New York, 1974, Lexington Books (Toronto).

[2] Transportation and the Elderly - an Ontario Review. P.E. Wade, April, 1982.

centres. An investigation of the transportation needs of seniors in London and Kingston, Ontario, provided the following information on urban distribution trends.

It is expected that by the year 2001, the total number of seniors in these centres will approximately double. The 1976 statistics indicated about 40% more seniors living in the central areas than in the suburban areas. At the same time there are about three times as many persons 45 years and older living in the suburbs than in the central city area. This indicates a likely major shift of seniors to the suburban areas of these centres over the next 20 years. This highlights the necessity to deal with the transportation problems and needs resulting from this likely redistribution of seniors.

Another source of useful information on seniors in urban areas comes from a report dealing with senior citizens' housing in Metropolitan Toronto.[1] In reviewing the needs and basis for senior citizens' housing in Metropolitan Toronto some useful background data was recorded.

Table II[1] provides data on the breakdown of housing used by the elderly in Ontario. This shows the preponderance of private housing use (88%) and reflects the expectation that in the future, the bulk of active seniors will not be in group housing or in institutions.

Table III[1] provides a measure of low income in Canada by age category, and reflects the disparity between the incomes of families versus that of unattached individuals.

---

[1] Senior Citizens' Housing. Locational Considerations and Social Implications. Antonia E. Andreae. Centre for Urban and Community Studies, University of Toronto, August, 1978.

Table II

HOUSING FOR THE ELDERLY IN ONTARIO -1975-

Type of Housing	Per Cent of Elderly in Housing Type	
Well Elderly		
Private Housing Market[1]		
Maintaining own household	69.0	
Living with relatives	13.0	
Lodging	6.0	
		88.0
Senior Citizens' Housing[2]		
Ontario Housing Corporation	2.0	
Municipal and Voluntary Groups	2.2	
		4.2
Ill Elderly[3]		
Homes for Aged		
Municipal and Charitable	3.7	
Nursing Homes (private)	3.1	
Chronic Care Hospitals (municipal and religious)	.9	
Private Chronic Care Hospitals	.1	
		7.8
TOTAL ONTARIO POPULATION 65+	100.0	100.0

SOURCES: [1]Statistics Canada, Households by Type Showing Selected Characteristics of Head, estimated from Table 44.

[2]Canadian Council on Social Development, Housing the Elderly, 1976, pp. 132-34.

[3]Community and Social Services, Report of the Inter-ministry Committee on Residential Services, Province of Ontario, April 1975, Appendix H.

Table III

Percent Incidence of Low Income in Canada by Age Group

- 1975 -

Age Group	Families	Unattached Individuals
Under 24	16.2	37.2
25 - 34	10.9	14.0
35 - 44	10.1	18.2
45 - 54	8.5	30.6
55 - 64	9.4	43.8
65 - 69	18.7	49.0
70+	24.8	64.9

NOTES: Low income is defined as those families or individuals spending over 62% of income on necessities (food, shelter, clothing). The actual limit depends on the size of the family and area of residence (i.e. metropolitan, rural areas).

SOURCE: Statistics Canada, Income Distribution by Size in Canada, Table 78.

A subject dealt with in this report involves the ranking of trip destinations and measures of critical distance for seniors' access Figure 3[1] shows a recommended listing oriented to the siting of seniors' housing facilities. The results are based largely on surveys of travel behaviour carried out in Philadelphia and Regina.

Another useful source of data concerns the changing distribution of seniors in Metropolitan Toronto over time. This is illustrated by Figures 4[1] and 5[1] which demonstrate the extent to which densities of seniors are increasing throughout the area and particularly into the suburban area. The pattern appears to reflect the rapid transit network configuration.

Finally, Figure 6[1] reflects an analysis of some ten citizens' housing facilities in Metropolitan Toronto in relation to the aforementioned measure of critical distance. This chart shows that of the ten facilities, only three are

[1]Senior Citizens Housing. Locational Considerations and Social Implications. Antonia E. Andreae. Centre for Urban and Community Studies, University of Toronto, August, 1978.

Figure 3

CRITICAL DISTANCE MEASURES TO SELECTED FACILITIES

Facility	Rank of Importance[1]	Critical Distance[2]	Recommended Distance[3]
Grocery store	1	2-3 blocks	1 block
Bus stop	2	1-2 blocks	adjacent to site
house of worship	3	1/4 - 1/2 mile	1/2 mile
Drug store	4	3 blocks	1 block
Clinic or hospital	5	1/4 - 1/2 mile	1 mile
Bank	6	1/4 mile	1/4 mile
Social centre	7	indeterminate	on site if feasible
Library	8	1 mile	1/2 mile
News - cigar - store	9	1/4 mile	1/4 mile
Restaurant	10	1/4 - 1/2 mile	no consensus
Movie house	11	1 mile	1 mile
Bar	12	indeterminate	no importance

Notes: 1: Based on the number of times facility mentioned as "important" in the location of a housing development for the elderly.

2: Based on the actual distance from a given facility in cases where dissatisfaction had been expressed by the residents.

3: Based on the apparent consensus of the respondents as to the proper distance to each facility.

Source: Paul Niebanck and John B. Pope The Elderly in Older Urban Areas (Philadelphia: University of Pennsylvania, Institute for Environmental Studies, 1965) p. 64.

FIGURE 4

METROPOLITAN TORONTO
POPULATION 65 AND OVER BY CENSUS TRACT - 1966

Source: Social Planning Council of Metropolitan Toronto

Figure 5

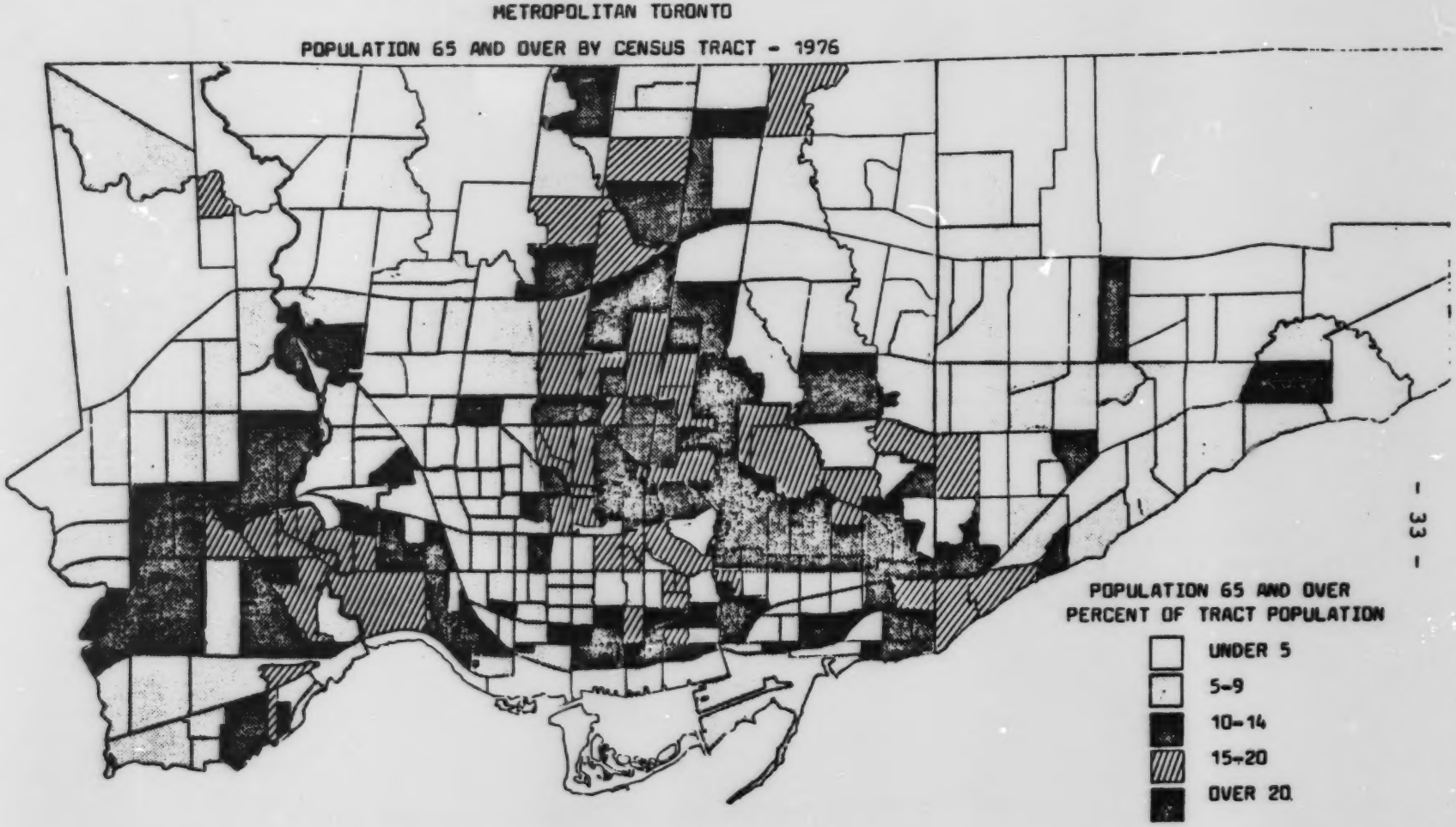
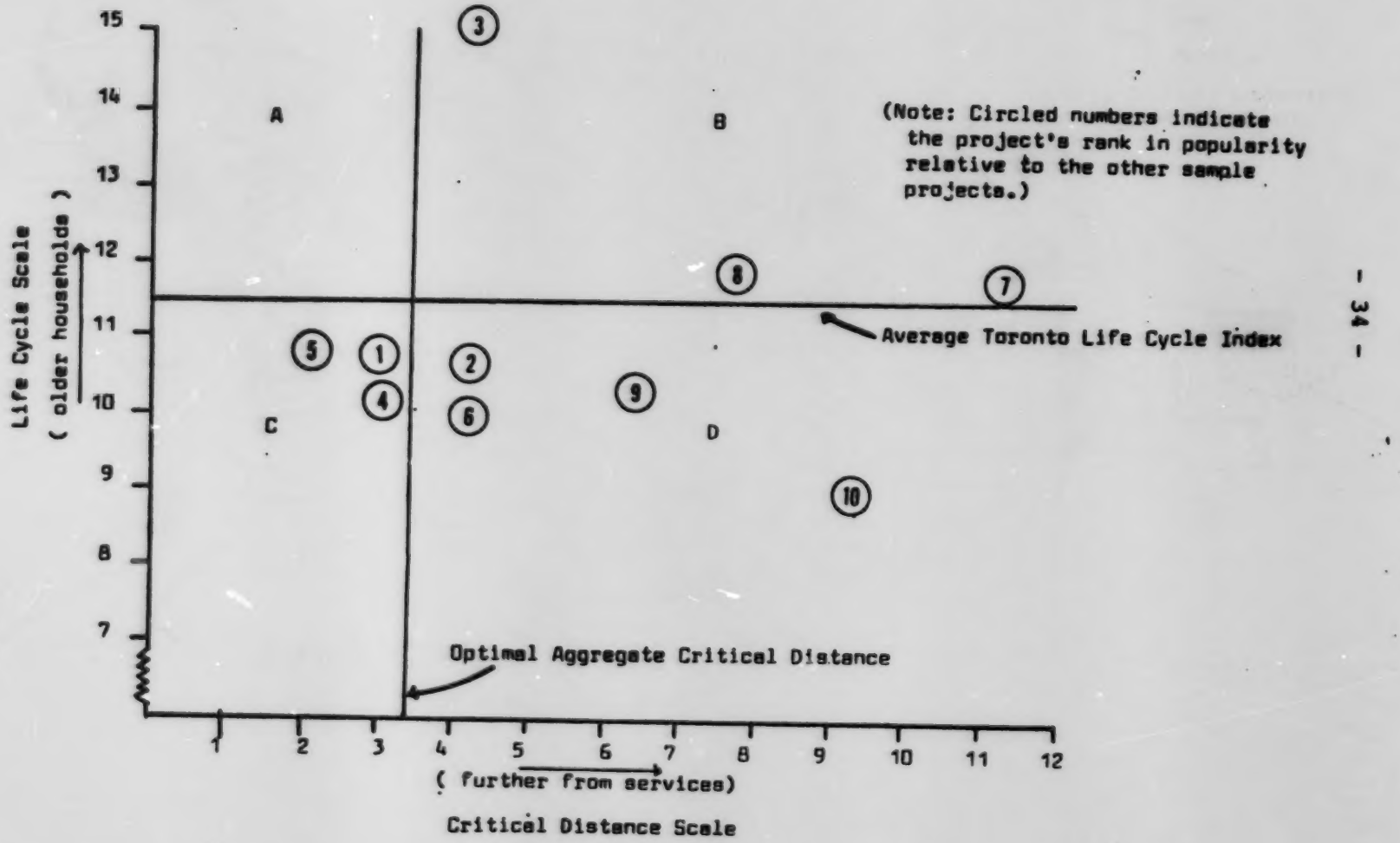

METROPOLITAN TORONTO
POPULATION 65 AND OVER BY CENSUS TRACT - 1976
POPULATION 65 AND OVER
PERCENT OF TRACT POPULATION
UNDER 5
5-9
10-14
15-20
OVER 20

Figure 6

LIFE CYCLE AND CRITICAL DISTANCE SCORING OF SAMPLE PROJECTS



rated acceptable in terms of access distance to important destinations. (Note: Life Cycle Scale reflects the orientation of the neighbourhood to prevailing age of population - the lower the numerical rating, the younger the neighbourhood population.)

2.4 Summary and Conclusions

2.4.2 Overall Status[1]

Income - Unattached seniors - 42% females and 33% males over 65 years in 1979 suffered from incomes below cut-off level. (53% of unattached seniors over 70 years of age in 1979 had unacceptable incomes.)

Labour/Employment - The percentage of elderly women participating in the work force is increasing. An anticated problem is transport of aging unattached self-employed women (e.g. cleaning women, etc.).

Health - Over 75 years of age physical capacities decline. The stated policy of home delivery of social services to seniors (particularly late elderly) will create a heavy demand for costly transportation services.

Housing and Environment - Since many future seniors will remain in their homes, a degree of dispersal of seniors throughout the community can be expected.

The Family - The number of persons living alone is increasing - in 1976, 34% of females and 15% of males were living alone.

In sum, transportation needs will occur as a result of:
- low income, isolated female elderly who wish to work;
- delivery of social services to late elderly in isolated circumstances (particularly in rural areas);
- general transportation to late elderly.

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[1] Source: Canadian Government Report on Aging, Department of National Health and Welfare, Ottawa, June 1982.

2.4.3 Basic Demographic Statistics and Forecasts

Forecast levels of elderly (% national population)[1]:

	Total 65+ (% total pop'n)	Female 65+ (% total female pop'n)	Male 65+ (% total male pop'n)	Total 75+ (% total population)
1981	9.7%	11.0%	8.4%	3.6%
2001	11.2	13.2	9.0	5.0
2026	16.0	18.6	13.2	6.3

Continuing high rate of increase of late elderly, low early numbers of elderly males, high and accelerating rate of female elderly increase.

Physical Disability[2]- Increasing disability by age (1976 data):

age group	% Transportation Handicapped by age group population	% increase between age groups
65 - 69	16%	
70 - 79	25%	56%
80+	34%	36%

Over 80% of transportation handicapped can use public transit with difficulty.

Economic Factors[3]- Pattern of lower incomes in elderly, female, and single categories:

- (1977 data) - female family heads (all age groups) have 48% less income than male family heads;
- (1975 data) - 45% less income for elderly family units (65+) and family units (all ages) - (unchanged from 1969 to 1975);
- 45% less income for elderly singles (65+) and all elderly family units (65+) (12.5% differential increase from 1969 to 1975).

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[1] Age, Sex, and Marital Status. Catalogue No. 92-901. Volume I: National Series, 1981 Census of Canada, Statistics Canada.

[2] Bibliography, Reference 12.

[3] Bibliography, Reference 11.

Automobile Ownership - Approximately 50% of seniors' households have cars (1977 data). Expect this to increase slightly in the future.

2.4.4 Locational and Related Information

National Patterns[1] - Provincial patterns range from three provinces with high concentrations of seniors (P.E.I., Saskatchewan and Manitoba) and three with low concentrations (Quebec, Newfoundland and Alberta); 75% of seniors are located in Ontario, Quebec and B.C. combined; 50% are located in cities over 100,000, and about one-third in specifically rural areas (those remaining on farms make up small proportion).

Contrast of heavy proportion of females in urban centres with equal numbers of male and female seniors in rural areas.

Provincial Patterns[2] - High proportions of seniors in areas of combined tourism and low-level farm economy, and in areas of high intensity farming areas. Low proportions in ex-urbia around largest centres (Toronto, Ottawa and Hamilton), as well as in mining and resources extraction regions.

Urban Patterns[3] - Heavy concentrations of seniors in urban centres. Strong trend expected over 20 years of shift of seniors to suburban areas, living primarily in private housing.

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[1]Bibliography, References 8 and 11.

[2]Bibliography, Reference 2.

[3]Transportation and the Elderly - An Ontario Review. Unpublished paper, P.E. Wade, April 1982.

2.4.5 Conclusions

Factors
- low income trends - elderly, single, females;
- dependence of "late" elderly (75+);
- increasing numbers of "late" elderly;
- high home ownership by seniors;
- goal of home delivery of social services;
- increasing number of elderly singles;
- high proportion of transportation handicapped can use public transit;
- increasing number of elderly car owners and users (present ownership level - 50%);
- large proportion of seniors in rural areas (mostly couples);
- large proportion of senior females in urban suburbs (mostly single).

3. TRAVEL BEHAVIOUR AND NEEDS OF SENIORS

3.1 Introduction

The purpose of this Chapter is to assess the likely disposition of future seniors in terms of special mobility and access needs, and how these relate to:

- social/psychological characteristics;
- economic and physical status;
- location in the community.

Therefore, we would like to have an understanding of the nature and level of travel demand according to:

- location;
- life-style grouping;
- physical capability;
- etc.;

so that it will be possible to identify the transportation service requirements and related technology needs.

3.2 Who is a Senior?

In this study (as in most other studies of the elderly), we have arbitrarily defined a senior to be any person over 65 years of age. Before getting into a discussion of the travel behaviour of seniors, it is useful to be more specific about the characteristics of this population group. Chapter 1, dealing with demographic factors, serves to identify many of their characteristics, including:

- income;
- labour force participation;
- health;
- car ownership;
- housing requirements;
- family structure and orientation.

From a transportation need perspective, some of the most important characteristics of the elderly may be summarized as follows:

(a) The person may have retired from a regular occupation, and therefore no longer make regular daily trips to and from a place of business.[1] This is one characteristic where the arbitrary age of 65 gives us a little difficulty. There is an important increasing trend towards variable retirement age. Many persons, because of their desire to travel, to become occupied in other activities, or because of their health, choose to retire at a much earlier age than 65. Conversely, there are those who are able and willing, and given the opportunity to do so by their employer, work well beyond a "normal" retirement age of 65. Also, many seniors take up part-time employment after retirement from a regular job.

(b) The person may have a physical disability. For this characteristic, it is important to distinguish between the "young-old" (age 65 to 75) and the "old-old" (over age 75). Studies have shown that the prevalence of physical disabilities among the young-old is not appreciably higher than for younger age groups. It is only among the old-old that physical disabilities start to become significant. Probably the two most important physical disabilities relating to transportation are musculo-skeletal impairments and sight impairments.

(c) The person may be economically disadvantaged due to a lack of a regular income.[2] While this has been a significant problem in the past, it is becoming less so among the elderly because of the almost universal adoption of company pension schemes and the CPP. Older persons generally have much lower income requirements than persons in family-rearing

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[1]Bibliography, Reference 21.

[2]Bibliography, Reference 9.

age groups. Even though a person's regular income has dropped abruptly upon retirement, there is often an accumulation of substantial investment in real estate and other securities which can be converted into adequate income for the remainder of one's life.

(d) The person may be disposed to make more non-work trips (e.g. shopping, social, recreation). When most people retire from a regular job, there is a significant change in life-style, mainly because of the increased amount of free time available, and the lack of need to be geographically close to the place of work.

An understanding of the above characteristics of seniors, therefore, helps to identify some of the transportation service features that may be required to meet their needs. These service features can include the following:

- some form of transportation cost subsidization (for those who are economically disadvantaged);
- some form of special vehicular service for those who are handicapped with a physical disability;
- ease of transportation access to social, recreation, religious activities, medical and shopping.

It is worth noting that at least the first two of these features might apply equally to persons under age 65. In other words, age may not be the only factor (or at least an important factor) in determining special transportation requirements within our society.

3.3 Behavioural Data

There is a lot of behaviour data available, mostly from U.S. sources, but also some Canadian, which show average daily trip making rates, proportion of trips by trip purpose,

proportion of trips by travel mode, etc. The problem with a large proportion of this data is that it relates to the total elderly population, rather than to specific sub-groups. Population in the age group over 65 years of age tends to be more heterogeneous than any other age group. For example, the majority of persons are not working, but there are also a substantial number who are employed. The majority of persons over 65 are neither physically handicapped or economically disadvantaged; yet there is a substantial number, particularly in the older age group, who are one or the other, or both.

Table IV

Trips by Persons 60 Yrs. of Age or Older

Miami, Florida[1]

Trips by Purpose

(as percent of all trips)

Purpose	Percent
shopping/personal business	22.4
religious and club activities	2.1
work/volunteer work	6.0
learning/school	0.3
medical	3.1
relaxation/enjoyment	9.7
other	16.8
return home	39.6
	100.0

Overall average trip rate - 1.46 trips per person per day.

[1] Elderly Mobility and Transportation Services: Some Survey Evidence. Ulrich, Ernst, and Carol Everett, January 1981, The Urban Institute, Washington, D.C.

Table V

Trips by Persons 60 Yrs. of Age or Older

Miami, Florida[1]

Trips by Mode

(as percent of all trips)

Mode	Percent
automobile - driver	42.7
automobile - passenger	21.7
bus	12.8
taxicab	0.9
human service transportation[2]	0.8
walking	19.3
other	1.8
	100.0

Table VI

Trips by Persons 60 Yrs. of Age or Older

Miami, Florida[1]

Trip Rates

(trips per person per day[3])

Sex	
Male	1.60
Female	1.30
Income	
Under $5,000	1.05
$5,000 or more	1.65
Handicapped Status	
Handicapped	0.90
No mobility limitation	1.70

Overall average trips per person per day - 1.46.

[1] Ibid.
[2] Transportation services provided by social service institutions.
[3] Point to point trip.

Table VII

Trips by Elderly Persons Receiving Social Services

Philadelphia, Pennsylvania[1]

Trips by Mode

(as percent of all trips)

Mode	Percent
automobile - driver	11.4
automobile - passenger	13.0
bus	41.7
taxicab	-
human service transportation	12.5
walking	14.2
none	7.2
	100.0

An example of the type of data that are currently available is given by Ernst and Everett (see above), in Tables IV, V and VI. As already mentioned, there is a problem with the lack of breakdown of trip purpose and travel mode according to an elderly population sub-group (e.g. handicapped vs non-handicapped, working vs non-working). An attempt to focus on a particular elderly population sub-group in Philadelphia is reported by Stirner.[1] It is interesting to compare the travel modal break-down in Table V with that shown in Table VII. Table VII is the mode break-down for elderly persons receiving social services; whereas Table V is for all persons over 60 years of age. The mode break-down shown in Table VII would be different again if the data were segregated into handicapped vs non-handicapped.

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[1]The Transportation Needs of Elderly in a Large Urban Environment. Fritz W. Stirner, The Gerontologist, Vol. 1d, No. 2, 1978.

3.4 Travel Need

We study travel behaviour because this type of data is relatively easy to obtain, and we assume that travel behaviour reflects travel desire or travel need. In fact, in the case of seniors, there may be many constraints, including physical handicaps and economic problems, that prevent transportation needs from being adequately satisfied. Consequently, there may be a considerable gap between travel behaviour and travel need. This gap is often referred to as latent demand. Miller[1] undertook a survey of elderly persons in Chicago in an attempt to measure latent demand. He points out that the latent demand for transportation exists wherever there is a latent demand for activity participation. Latent demand related to non-transportation factors is an implied latent demand. Through a carefully designed questionnaire he was able to identify the degree to which demand was being satisfied for a detailed long list of activities (e.g. go to a movie, go out to eat, go to the bank, etc.). Those activities that showed the greatest expression of latent demand are social and recreational. Basic needs, such as medical trips, are generally fulfilled and have less latent demand. Transportation service and its lack proved to be an important factor contributing to much of the latent demand that was identified.

3.5 Forecasting Travel Behaviour

There is evidence that the living patterns and transportation requirements of the elderly are shifting, and that in the next two decades they may be significantly different from present patterns. It is likely that in the 1990's, the population in the age group over 65 will be even more hetero-

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[1] Latent Travel Demands of the Handicapped and Elderly. Jack Miller, Alan M. Voorhees and Associates, Inc., Transportation Research Record. 618, 1976.

geneous than it is today, the elderly will be more affluent, there will be more drivers, and they will be dispersed in a variety of living environments of which an increasing proportion will be at lower densities. Wachs and Blanchard[1] make a number of important observations leading to a scenario for the elderly in the future.

Improved Health. If increases in future age span are the result of survival of illnesses that were previously fatal, then there will be more handicapped persons. However, if increases in life span are the result of generally improved health among the elderly, there will be relatively larger numbers of healthy elderly among the older population in the year 2000. The relations between morbidity, mortality and life expectancy are complex, and it is difficult to be certain about the health status of the future elderly. Those surviving to age 75 or beyond may well be expected to have health conditions limiting their physical mobility and living patterns. Significant increases can be expected, however, in the number of early elderly (65-75) persons capable of relatively vigorous activity patterns with relatively few constraints on their mobility.

Improved Economic Welfare. It is recognized that the level of money income of the elderly is typically low, but that this alone is an inadequate indicator of the economic welfare of this population group. It is estimated that 80 per cent of the elderly households in the U.S. live in owner-occupied dwelling units, which are more frequently owned free and clear by the occupants than is the case for other age groups. Similarly, savings and other investments are impor-

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[1] Life-Styles and Transportation Needs of the Elderly in the Future. Martin Wachs and Robert D. Blanchard, School of Architecture and Urban Planning, U.C.L.A., Transportation Research Record. 618, 1976.

tant sources of economic security.

Anticipated Changes in Mobility. Present data show that the elderly are much less mobile than younger age cohorts, and that car ownership reduces dramatically over age 65, as shown in Table VIII. However, the location and residential density (and car ownership) patterns of the elderly are more a function of aging itself. It is likely that most of the elderly (particularly women) who do not drive an automobile to-day are merely reflecting the life-styles of earlier decades. To-day, most young people (both men and women) learn how to drive. This will have important implications for the transportation needs and travel behaviour for the elderly in the future.

Table VIII[1]

U.S. Car Ownership, 1955

Age of Household Head	Per Cent of Households Owning	
	No Car	At Least One Car
Under 25	19.3	80.7
25 to 34	12.0	88.0
35 to 44	11.6	88.4
45 to 54	13.6	86.4
55 to 64	19.7	80.3
65 and over	44.9	55.1

[1]United States Department of Transportation.

4. FOCUS GROUPS OF SENIORS IN RELATION TO MOBILITY AND OTHER CONSTRAINTS

According to the National Census of 1981 the total number of persons in Canada over the age of 65 in 1981 was 2,362,000. This is an amount almost as great as the population of British Columbia. The senior population in Canada is an extensive grouping representing a heterogeneous mix of physical, ethnic, economic, social and geographic characteristics. An objective of the current study was to segregate this elderly population into sub-populations who represent reasonably homogeneous and identifiable groupings, and which, at the same time, can be expected to experience unique and consistent transportation needs or deficiencies. The intent is that these sub-categories or Focus Groups of the elderly population can be related to specific patterns of mobility or accessibility needs and in turn to recommended technology and service measures.

4.1 Demographic Trends

In the discussion in Chapter 2 on the general demography of present and future seniors in Canada, a number of anticipated issues and social circumstances are listed, including the following expected trends:

- a trend to increasing numbers of single female elderly with incomes often below the low income cutoff levels;
- an increasing number of late elderly with accompanying dependence on support agencies or resources;
- a trend to increasing occupation and ownership of private residences by seniors;
- a policy of government to encourage the occupation of their own homes and for the authorities to deliver support services to seniors in their homes;

- an increasing number of ambulatory disabled persons who will be using private and regular transit vehicles with some difficulty;
- an increasing number of elderly car owners and operators;
- an increasing number of seniors in rural areas;
- an increasing number of seniors in suburban areas of all sizes of cities.

4.2 Socio-economic Characteristics

It is apparent as well that there are a number of key socio-economic characteristics of seniors affecting their status re mobility and accessibility. These include:

- income status;
- employment status;
- age (early (65-75) and late (75+) elderly);
- marital status;
- disability status;
- car ownership and use;
- physical location in the community.

Finally, in the selection of key subgroupings of seniors for purposes of transportation measures, in addition to the demographic trends and socio-economic factors discussed above, a major input at this stage are the significant issues related to transportation needs and deficiencies of seniors. Some six transportation issues have been identified and are discussed as follows:

a) Elderly Isolation. It is expected that to an increasing degree in the future, seniors will locate in the suburban and rural areas resulting in

inadequate access to conventional public transit services. This is expected to result from the following circumstances:

- increasing concentrations of seniors in suburban and rural areas;
- as the average age of seniors increases, physical disability of seniors in using public services will increase;
- a stated policy of government encouraging seniors to remain in their own homes.

b) Service Delivery. As a result of the above-mentioned policy of delivering public and community services to seniors in their homes (either by home delivery or transport of seniors to other locations), a growing need is apparent for the means of integrating and optimizing a number of social service functions, such as:

- homemakers;
- home nursing;
- public health nurses;
- ambulance services;
- meals on wheels and wheels to meals;
- home repair service;
- counselling;
- library services;
- access to community centres;
- education;
- recreational activities.

In rural areas such services often provide transport for a range of seniors' trip purposes. A need exists

to develop procedures for achieving greater efficiency and cost effectiveness for the very heavy transportation operations associated with the delivery of the above social services.

c) Use of Public Transit by Seniors. Statistics on the decline of physical capabilities indicate that age 75 represents a rough boundary between a period of relatively unconstrained physical abilities and a period of declining abilities.[1] Seniors in the over 75 age bracket suffer increasingly from disabilities in such categories as sight, hearing and mechanical functions, and often combinations of disabilities. It is postulated that a need exists for integrated research into the physical needs of ambulatory but disabled users and the specification of necessary modifications to existing public transit vehicles and terminal facilities.

d) Elderly Pedestrians. Statistical records provide a picture of high fatality rates resulting from traffic accidents involving late elderly pedestrians.[2] Measures used to alleviate this problem include:

- information systems and training programs oriented to seniors' pedestrian behaviour;
- programs of information and training directed at driver awareness of senior pedestrian behaviour;
- micro planning of urban sites and pedestrian amenities covering;
  - intersection signalling,
  - street furniture, shelters, etc.,
  - development of land use corridors and multiple-use sites.

With the anticipated growth in numbers of late

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[1] See Physical Performance Characteristics, page 70.

See Bibliography, items 15 and 17.

elderly in the central areas of Canadian cities there is an evident need for appropriate investigation and research in the above subject areas.

e) Cost Effective Demand-Responsive Transit Services. The important factor in alleviating transportation isolation of seniors is the use of demand-responsive paratransit services. In order to correct the prevailing cost inefficiencies of such services it will be necessary to apply cost-effective measures (e.g. fuel-efficient vehicles, computerized control systems, use of volunteer drivers, etc.).

f) Improved Operation of Private Vehicles by Senior Drivers. Demographic forecasts indicate an increase in the number of seniors owning and driving automobiles. With the anticipated average age of such drivers increasing, a greater incidence of physical disabilities will occur. Current research tends to show that elderly drivers experience a lower average accident rate than the remainder of the driving public.[1] This apparently results from compensation by seniors for any disabilities that they might have (i.e. slower reflexes, decreased night vision, etc.). Nevertheless, as the proportion of such drivers in the traffic increases, it is essential that the authorities recognize this phenomenon and conduct relevant research and implement necessary countermeasures.

4.3 Elderly Focus Groups

As the outcome of examining seniors' demography, travel behaviour and anticipated accessibility problems in relation to current transportation technology, some four specific categories of seniors' status were identified. These consist of:

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1. a) Case, W.C. and Hulbert, S., "Driving Ability as Affected by Age", UCLA Institute of Transportation and Traffic Engineering, March 1970;

   b) Jones, M.G., "Driver Performance Measures," Traffic Safety Centre, University of Southern California, March 1977.

i) Transportation-isolated elderly;

ii) Ambulatory/disabled elderly;

iii) Late elderly;

iv) Seniors as drivers.

The following discussion deals with the implications of each of these groups in terms of present and future numbers, demography, travel behaviour, social/psychological characteristics and mobility needs.

i) Transportation-Isolated Elderly

Transportation isolation is defined as the inability of users to consistently make desired trips. This can be due to a number of factors:

- physical isolation from public-transit services;
- physical, emotional, mental handicaps that inhibit use of transit services;
- lack of access to the use of a private motor vehicle.

Numbers and Demography

In the quantification of the above Elderly Focus Groups a number of sources are useful. An important source is the Statistics Canada census urban-rural distribution categories of:

Urban:	500,000 population and over,
	100,000 - 499,999,
	30,000 - 99,999,
	10,000 - 29,999,
	under 10,000.
Rural:	farm,
	non-farm.

These distribution categories are discussed as follows in terms of the assumptions and criteria applied in estimating the total numbers of persons anticipated in this Focus Group.

- Urban Category

a) Urban: 500,000 and over. This category covers the larger cities where a high level of conventional public transit services can be expected. Assumptions:
   - high income seniors, whether disabled or not, will be excluded (35% of senior population, 1981).[1]
   - include ambulatory/disabled category (17% of seniors).[2]

   Estimated amount to be computed by multiplying 0.17 x 0.65 x the total seniors in this category.
   Future conditions (assumptions):
   Income category (low and medium income) 2001 - 62%, 2026 - 60%.
   Ambulatory/disabled - 2001 - 13%, 2026 - 10%.

b) Urban: 100,000 to 499,999. This category covers smaller cities, all with fixed-route surface transit systems, but with less complete coverage than the larger urban category. Assumptions:
   - exclude high-income elderly category (35% of senior population - 1981).[1]
   - assume 10% of senior population to be transportation isolated.[3] This is a conservative estimate based on trends in medium-sized cities in Ontario.

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[1]Assumption; based on Chart 7, Canada's Elderly, Statistics Canada, Catalogue 98-800E, 1979 and Table 78, Income Distribution by Size, Statistics Canada.

[2]Data Base Study for the Identification & Quantification of Transportation Handicapped Persons in Canada, Systems Approach Consultants Ltd., Prepared for Transport Canada, May, 1979 (Figures 4.4 and 4.6).

[3]Transportation and the Elderly. An Ontario Review. Philip E. Wade, Boston Henry Quinn, March 1982.

- include ambulatory/disabled seniors (17% of seniors).[1]

Estimation factor: $(0.65 \times 0.17) + (1-0.17) \times 0.1 \times 0.65$.

Future conditions (assumptions):

- Income category (low and medium income) 2001 - 62%, 2026 - 60%.
- Ambulatory/disabled - 2001 - 13%, 2026 - 10%.
- Transportation isolation - 2001 - 20%, 2026 - 15%.

c) Urban: 30,000 to 99,999. Similar assumptions as for b).

d) Urban: 10,000 to 29,999. Communities in this category in most cases do not have fixed-route or other municipal transit service. Assumptions: those seniors that do not own or operate a car are assumed transportation isolated (approximately 50% of senior population).[2]

Future conditions (assumptions):

Carless seniors: 2001 - 40%, 2026 - 45%.

e) Urban: less than 10,000 population. This category includes all the smaller municipalities which can be assumed to have a rural orientation and related behaviour patterns.

It is assumed that the research carried out by the Rural Development Outreach Project at the University of Guelph will apply to this category.

Assumption:

- include transportation disadvantaged (40% of senior population).[3]

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[1] Data Base Study for the Identification & Quantification of Transportation Handicapped Persons in Canada, Systems Approach Consultants Ltd., Prepared for Transport Canada, May, 1979 (Figures 4.4 and 4.6).

[2] Judgmental estimate based on incomplete data from Canadian Governmental Report on Aging (1982) and 1979 travel surveys in Metropolitan Toronto and Durham Region.

[3] Profile of the Transportation Disadvantaged in a Rural Area in Southwestern Ontario. Canadian Surface Transportation Administration, Transport Canada, March, 1979.

Future conditions: assume no change in this factor.

- Rural

f) Rural: Farm. Assumption as above; include transportation disadvantaged (40% of senior population).[1]

Future conditions: assume no change.

g) Rural: Non-Farm. Assumptions as above; include transportation disadvantaged (40% of senior population).[1]

Future conditions: assume no change.

Population of Urban/Rural Distribution Cohorts.

Table 9 below lists the number of seniors found in the seven Urban Rural Distribution Cohorts.[2] Since no projections have been made for the cohort populations, it is not possible to forecast the population of seniors in these categories.

TABLE IX

Urban/Rural Cohorts

Total Population and Seniors (1981)

Urban/Rural Cohort	Cohort Population				
	% total population	total population	% seniors (65+)	total seniors	% of total
Urban:					
a) 500,000+	36.2%	8,812,200	9.4%	828,300	34.2%
b) 100,000 - 499,999	12.4	3,018,500	8.7	262,600	10.7
c) 30,000 - 99,999	7.1	1,728,400	8.9	153,800	6.3
d) 10,000 - 29,999	6.2	1,509,300	8.8	132,800	5.4
e) less than 10,000	11.1	2,702,100	11.0	297,200	12.2
Rural:					
f) Farm	2.4	584,200	5.4	31,500	1.2
g) Non-Farm	24.6	5,980,400	12.0	718,600	30.0
TOTALS	100.0	24,343,100	9.7	2,414,800[3]	100.00

[1] Profile of the Transportation Disadvantaged in a Rural Area of Southwestern Ontario. Canadian Surface Transportation Administration, Transport Canada, March, 1979.

[2] Population Projections for Canada and the Provinces. Catalogue 91-520, Statistics Canada.

[3] Error due to rounding.

Total Seniors in Transportation-Isolated Category

Estimates of total seniors by Urban-Rural Distribution cohort for 1981 data are recorded as follows:

TABLE X

Transportation-Isolated Seniors (1981)

Urban/Rural Cohort	total seniors	factor	transportation isolated seniors	% total
Urban:				
a) 500,000+	828,300	0.11	91,100	14.1%
b) 100,000 - 499,999	262,600	0.164	43,100	6.7
c) 30,000 - 99,999	153,800	0.164	25,200	3.9
d) 10,000 - 29,999	132,800	0.5	66,400	10.3
e) less than 10,000	297,200	0.4	118,900	18.4
Rural:				
f) Farm	31,500	0.4	12,600	2.0
g) Non-Farm	718,600	0.4	287,400	44.6
Total	2,414,800	0.23	552,800	100.0%

It is apparent that the worst conditions of elderly isolation are expected to occur in the rural and small municipal categories (categories d), e) and g)) which, according to Table 10, make up about 73% of the total isolation of seniors. This reflects the assumption that seniors in municipalities of over 30,000 population have access to municipal transit services and other institutional facilities. Other attributes of isolated senior populations are discussed as follows:[1]

a) Urban: 500,000 and over

Recent census trends indicate a low increase (about one percent) in the total population of this cohort, which can possibly be expected to continue into the foreseeable future. The percentage of seniors and related categories (lower income and disability classes) as well are not expected to increase substantially. Accordingly, neither the total number of seniors, nor isolated seniors are expected to increase

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[1] In the following discussion, except where specific references are quoted, conclusions are based on author's conjecture.

significantly. On the basis of such findings it can be expected that seniors in the larger metropolitan areas in most cases will be well served in terms of accessibility and mobility.

Certain contingencies could create localized problems. Exceptional levels of immigration of non-native groups could create special cases of urban isolation resulting from low incomes, psychological isolation, etc. The subject of unattached females in large cities is a possible source of isolation, either as workers or non-employed. In many cases these will be non-drivers and will have low incomes. Single, elderly females are expected to make up about one-third of all seniors by the year 2000. Under conditions of economic decline, these could constitute a serious problem of isolation in major cities.

Another aspect of seniors in metropolitan areas is the expected shift of seniors to suburban districts, where access distances are long and transportation services are dispersed.[1] Measures for alleviating this situation will be needed, (for example; orientation of seniors to shopping centres for seniors' activities and social service needs). An important transportation issue to be addressed in metropolitan areas is the integration of the delivery of social services.

It can be expected that the densities and numbers found in large centres would create favourable logistics for such operations.

A key component of isolated seniors in major cities will be made up of late elderly and ambulatory/disabled elderly, and in many cases these factors will be combined. The subject of isolated seniors in large centres has apparently been subject to very little research, and assumptions that the problem will be

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[1]Bibliography Reference 28.

insignificant may turn out to be fallacious. Other aspects of isolated seniors in major centres and their anticipated characteristics over the next 40 years are discussed as follows:

- Isolation will not occur in the case of seniors in major centres solely because of physical isolation, but will often be the result of a combination of factors; some physical isolation, late elderly travellers, plus incidence of disability (visual, hearing, mechanical, emotional, mental) and bad weather conditions, that in combination result in difficulty in access to fixed-route services that the rest of the public finds little difficulty in using.
- It can be expected that future elderly in major centres will make up the most heterogeneous of any category of seniors (i.e. ethnic, economic, employment, housing, activities, etc.). Accordingly, it is risky to generalize about this group. Nevertheless, it is likely that future seniors in major centres can be described as follows:
  - better educated than at present;
  - exhibiting a demand for a wide variety of trip types reflecting the range of activities in large cities (e.g. social, recreational, cultural, community, medical, educational, etc.),
  - likely to maintain seniors' organizations oriented to articulation of, and lobbying for achieving satisfaction of senior's mobility needs,
  - higher income levels, and car ownership and operations.

The above, of course, describes the expected tendency and does not describe all seniors in these centres. The above characteristics indicate a more

independent and self-sufficient set of seniors with greater capability to avoid transportation isolation.

It is possible to generalize about time patterns over the next 40 years.[1]

- Up till the year 2000, the emerging seniors will tend towards the patterns described above of independence, auto-orientation, remaining in private homes, higher incomes, etc.
- It is likely that after the year 2000 a different generation of seniors will emerge which will be less oriented to home ownership and auto use and more inclined to intensive urban housing, public transit and dependence upon social services, etc. This indicates a possibly higher level of isolation occurring in these centres after the year 2000.

b) Urban: 100,000 to 499,999[1]

It is expected that the total population in this class of communities will decline slightly in the future. As well, the seniors' percentage of cohort total is expected to increase rather nominally in the future. At the same time, these communities have lower levels of service for fixed-route transit service and are expected to experience transit isolation in the extended areas of the community. Demographic patterns indicate a significant shift of senior to suburban areas over the next few years. Estimated isolation factors are:

1981 - 10%
2001 - 20%
2026 - 15%

Total seniors in this Urban/Rural cohort in 1981 represent some 10.7% of total senior population. Isolated seniors in this category in 1981 are estimated at 43,100, or 6.7% of total isolated seniors.

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[1]Based upon interpretation of various sources and researches on demography and travel behaviour (Bibliography, References 1 to 28).

As a result of the increase in seniors in the suburbs, it is expected that the total isolated seniors in this category will increase by 50% by 2000, but will decrease thereafter.

The socio/psychological and travel behaviour characteristics of this cohort can be considered essentially similar to cohort a) for the large metropolitan areas.

c) Urban: 30,000 to 99,999[1]

Expected growth patterns in this category of smaller urban centres can be assumed similar to that of cohort b) (100,000 to 499,999). These are centres with rudimentary public transit systems with likely higher levels of transportation isolation (without field data assume same factor as for b)). Cohort c) represents 25,200 or 3.9% of transportation isolated seniors. As a result of suburban shifts by seniors it is concluded that numbers of isolated seniors will increase by 50% by the year 2000, and thereafter decline in numbers.

In terms of characteristics of isolated seniors in this cohort (socio/psychological, economics, travel patterns and mobility needs, etc.) it can be expected that citizens in this size of community will reflect characteristics more typical of rural communities than of metropolitan areas. For example:

- more homogeneous and less heterogeneous (ethnicity, social and economic variants, etc.),
- lower incomes and possibly lower car ownership, and driving, etc.,
- lower range of educational levels and less diversity of trip patterns and demands.

These persons will tend to show rural patterns of independence, i.e. less dependence reflected in the form of lower trip levels and less demand for certain types of trips. This can be interpreted as a symptom of

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[1]Ibid.

travel demand frustration, an implicit form of isolation.

d) Urban: 10,000 to 29,999[1]

This cohort covers the municipal category generally without fixed-route public transit services, and in some cases without taxis. This is the transition zone between the urban and rural categories. This cohort represents 10.3% of isolated seniors, or 66,400 persons.

The criteria for isolation in this cohort is the number of carless seniors which is assumed to be 50%, an approximate average indicate by statistical sources.

The gross levels in this cohort (total population) are expected to decline slightly, with a corresponding slight increase in percentage levels of seniors. At the same time the number of carless seniors is expected to decline, thus indicating an overall decline in the size of this cohort.

In the case of basic characteristics of seniors in this category, it is assumed that they are assuming more closely the characteristics of rural dwellers as discussed under cohort c) above.

e) Urban: less than 10,000 population

This cohort represents an important segment of isolated seniors. This is reflected by the fact that this cohort represents 11.1% of the total population, 12.2% of total seniors, and 18.4% of total isolated seniors, the latter amounting to 118,900 isolated seniors in this cohort.

With regard to changing dimensions of this cohort, it is expected to remain fairly stable as a result of the counter effect of an expected increase in the percentage levels of seniors, plus an expected decrease in the gross population in this category.

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[1]Ibid.

This cohort can be considered a truly rural category since these municipalities will serve largely as service centres for rural farming areas or tourist activity. Virtually none of these municipalities will have conventional fixed-route transit services.

Characteristics of seniors in this category are described above in category c) as reflecting conditions expected in rural communities, i.e.:

- less heterogeneity of seniors than in metropolitan areas;
- likely lower incomes with resulting lower car ownership and driving by seniors, and lower level of trip experience.

Information on the subject of transportation disadvantaged in rural areas is based on the research carried out by the Rural Development Outreach Project of the University of Guelph.[1]

This project indicated that the major factor in providing personal transportation in rural areas is the private automobile. Furthermore, those that reside in small rural municipalities have greater mobility and undertake a wider range of trips than those residing outside of municipalities (partly because of the use of the walk modes within towns). The above research indicates a level of transportation handicap of about 40%.

- persons in these areas tend to exhibit less concern over inability to make trips and will perhaps be less active than urban dwellers in seeking assistance, indicating a lower overt trip demand. The

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[1] Profile of the Transportation Disadvantaged in a Rural Area of Southwestern Ontario. Prepared by Rural Development Outreach Project of the University of Guelph for Transport Canada, March, 1979.

fact that people in rural areas will make the usual range of trips when they have the opportunity indicates an implicit travel demand similar to seniors in large urban centres.

f) Rural: farm

This represents the smallest cohort with 2.4% of the total population, 1.2% of total seniors, and 2.0% of transportation isolated seniors - the latter representing a total of 12,600 isolated seniors. It is likely that cases of transportation isolation in rural areas would represent the worst conditions of isolation, although persons on farms would be expected to have greater access to vehicle use than other rural residences.

In terms of future conditions, little overall changes are expected as a result of declining % of seniors in total population, with an overall increase expected in the total population on the farm.

g) Rural: non-farm

This represents the largest sector of transportation isolated seniors, i.e.:

- 24.6% of total population,
- 30.0% of total seniors;
- 44.6% of transportation isolated seniors.

The latter representing a total of 28,,400 seniors. This represents without doubt the most important target area for coping with elderly transportation isolation. It is a critical condition that the largest isolated cohort exists in circumstances producing the lowest access level to conventional, municipal or private passenger transportation.

To a large degree these represent persons who have retired to rural areas, or have moved there during their working career. As a result, it can be postulated that this group is more heterogeneous than the more traditionally rural populations. In which case

it can be expected that this group will have a more variegated trip demand pattern than other rural communities and may be more active in seeking assistance to their mobility needs.

A striking point is that the statistical trends indicate the highest rate of growth for this cohort. In both cases, i.e. the future % rates of total seniors, and the total population of this category show likely high rates of future growth.

ii) Ambulatory/Disabled Seniors

The following data were used to compute numbers of ambulatory/disabled seniors.[1]

(1976 data)

Seniors - 8.7% total population

Transportation Handicapped (TH) - 4.97% total population

Senior TH - 40.5% Transportation Handicapped population

- (.405 x .0497) - 2.0% total population

- $\frac{.020}{.087}$ = 23.0% total seniors

Ambulatory/Disabled Seniors - (75% total TH population)

- 0.75 x 0.23 = 17% total seniors

Can compute amount of ambulatory seniors that would require assistance in using fixed-route public transit by applying the above factor (17%) to the elderly population of municipalities served by municipal transit systems (municipalities greater than 30,000 population) - 51.2% of total population (Table IX, page 58).

Total Ambulatory/Disabled Seniors (1981)

- 0.17 x 2,414,800 = 410,500

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[1] Data Base Study for the Identification and Quantification of Transportation Handicapped Persons in Canada. Systems Approach Consultants, Ltd., for Transport Canada, May, 1979.

A/D Seniors Served by Municipal Transit Services

- 0.17 x 0.512 x 2,414,800 = 210,200.

The characteristics of this group will reflect a preponderance of late elderly (approximately 25% more late elderly A/D seniors in proportion to numbers of seniors).

Since they can be considered to occur proportionately throughout the population, their characteristics will tend to reflect the population cohort they represent.

Assuming equal proportions in the seven urban/rural cohorts the distribution of A/D seniors would be approximately as follows:

Urban/Rural Cohort	Ambulatory/Disabled Seniors
Urban:	
a) 500,000+	140,800
b) 100,000 - 499,999	44,600
c) 30,000 - 99,999	26,100
d) 10,000 - 29,999	22,600
e) less than 10,000	50,500
Rural:	
f) farm	5,400
g) non-farm	122,200
TOTAL	412,200[1]

iii) Late Elderly

The Late Elderly category is defined as those seniors 75 years of age and older. The following Table indicates the levels of late elderly expected by the forecast years of 2001 and 2026.

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[1] Error due to rounding.

75 and Over Years of Age

Period	Total	% Seniors	Male	% Seniors	Female	% Seniors
1981	885,000	37.5%	339,000	14.4%	544,000	23.1%
2001	1,552,000	44.3	525,000	15.3	997,000	29.0
2026	2,305,000	39.2	805,000	13.7	1,500,000	25.5

The demographic and socio/psychological and economic characteristics of late elderly can be examined in terms of generational categories, and of physical performance characteristics:

Generational Categories

This is discussed in terms of two groupings:

i) those who are 75 in 1981 (current late elderly generation)

ii) those who will be 75 in 2001 (first stage early elderly).

i) The current late elderly generation experienced their formative years in the period of the first world war and the early 20's. They are not generally oriented to auto use and the consumption focus of the second world war generation. They are often found in apartment housing in the central area and it can be postulated that they tend to locate themselves conveniently to transit and urban services.

ii) The next generation late elderly (75 in 2001) experienced their formative years in the years of the depression and the second world war. They make up the generation that was highly motivated to achieve material success after the second world war (i.e. auto orientation, detached homes in the suburbs, high incomes, independent life style, etc.). This group will tend to redistribute the seniors into the suburbs, and it is expected that the serious cases of suburban isolation will occur around and after 2001. Many of this group have and will move into

the rural areas creating possible long term problems for social service delivery and other needs from isolation.

Physical Performance Characteristics

Age 75 has been seen as a broad cut-off point for sustained and declining physical performance characteristics of seniors. This phenomenon is quoted frequently by authorities in this field. The following two sources provide evidence to this effect.

Figure 7 illustrates data tabulated in an Australian report.[1] The curve demonstrates the increasing incidence of mobility restriction with increasing age. Figure 8 illustrates, the different patterns of age-related disability as recorded in a recent Transport Canada report on Transportation Handicapped Persons in Canada. Both curves display an upward movement in the curve occurring in the late 60's and early 70's. Figure 8 shows extreme rates of disability (i.e. hearing, visual and mechanical disability) in the older age categories.

iv) Elderly Drivers

It is expected that future seniors will own and drive automobiles to a greater degree than in the past, although no statistical forecasts to this effect have been prepared. As well, there is very little current information available on the possession of drivers' licences by seniors. A travel survey carried out in 1979 of Metropolitan Toronto and the Durham Region (i.e. Whitby, Oshawa Ontario area) indicates levels of seniors with drivers' licences as 41% in Metro-

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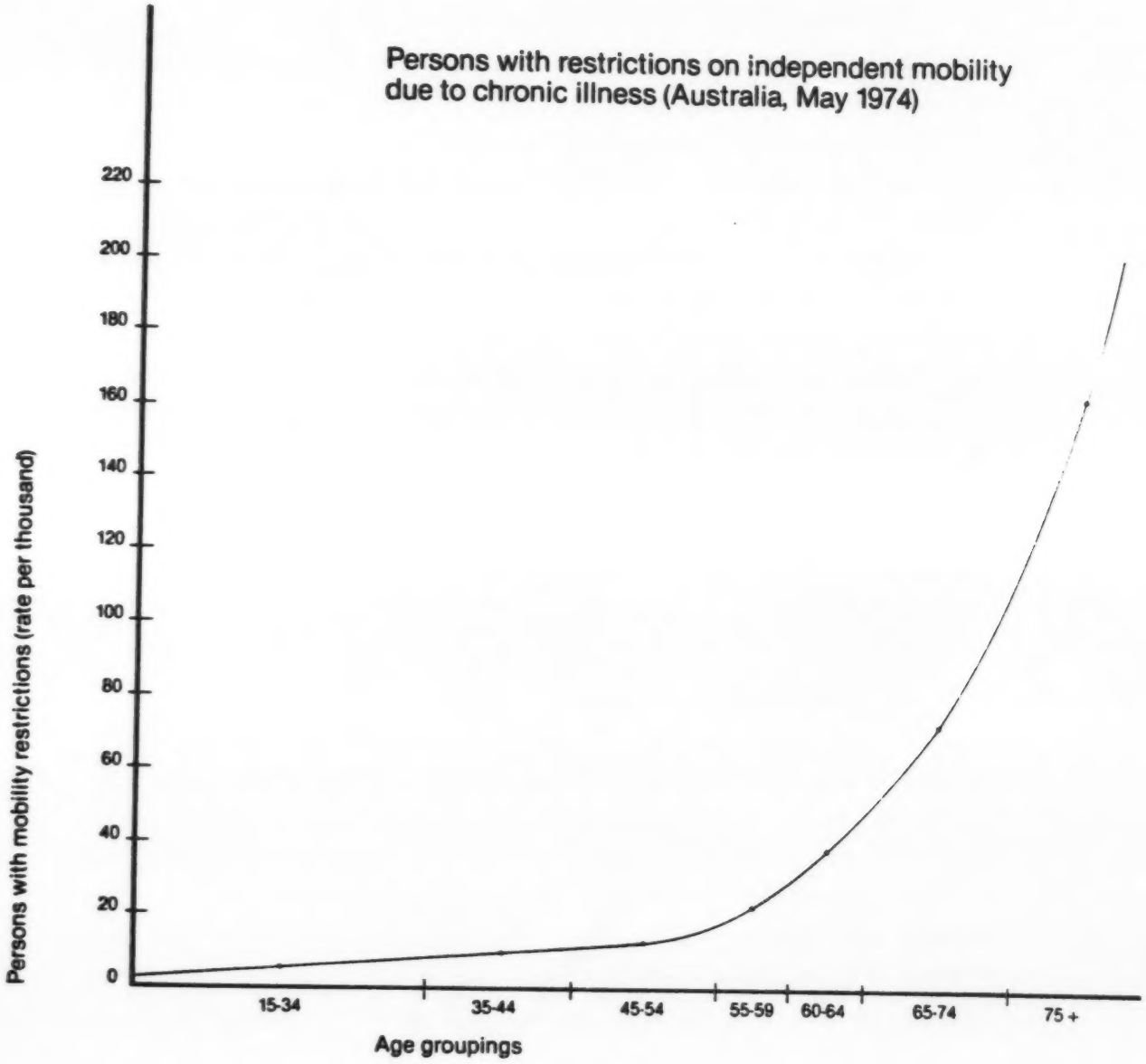
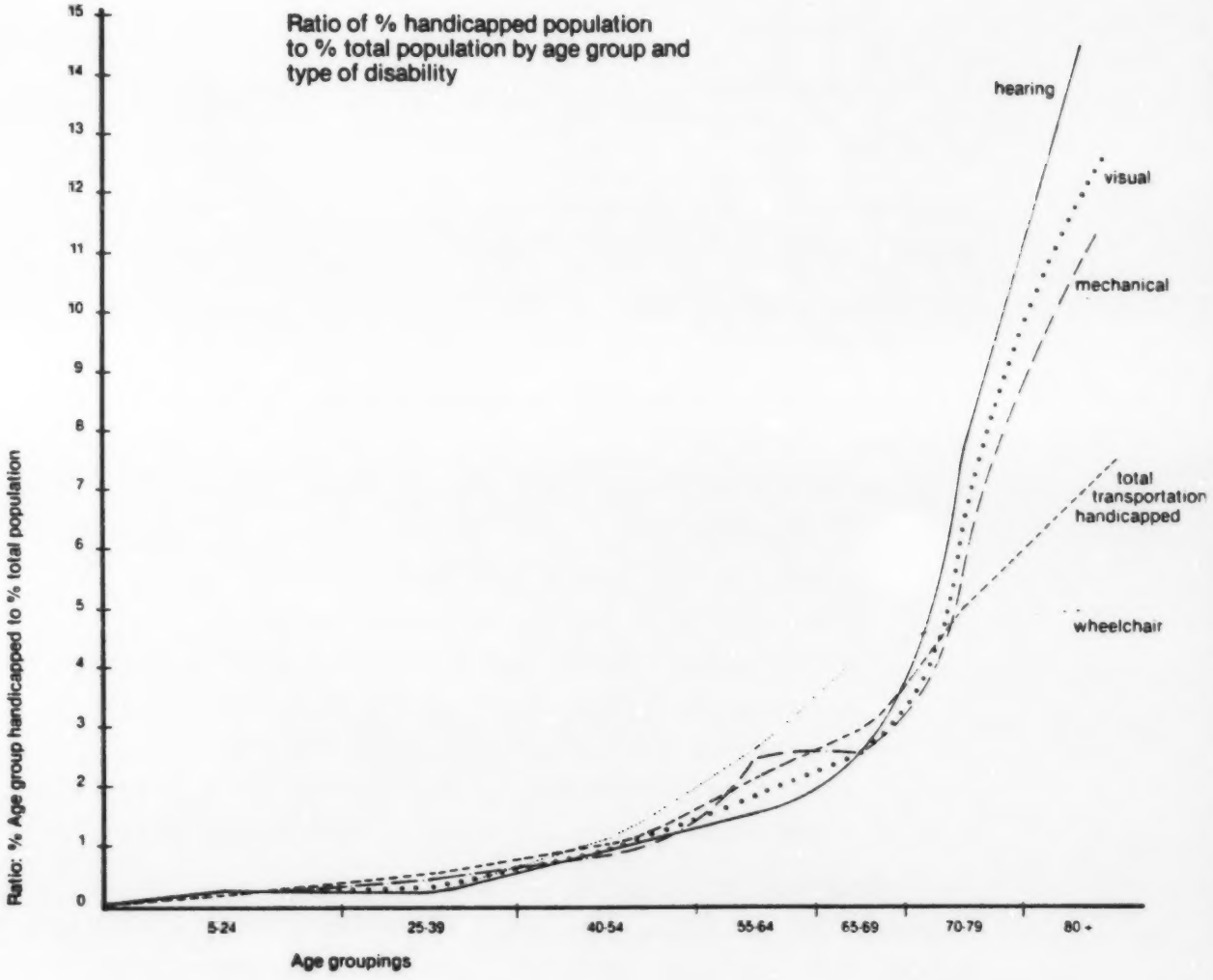
[1] Personal Mobility and Transport Requirements of the Elderly. J.M. Morris, Australian Road Research Board, AIR 344-1, October, 1979.

Figure 7



Source: Australian Bureau of Statistics. Chronic illness, injuries and impairments May 1974, Ref. No. 17.3

Figure 8



Source: Data base study for the identification & quantification of transportation handicapped persons in Canada
Summary report
Transport Canada, May 1979

politan Toronto and 52% in Durham. This suggests that in areas of rural character these levels are higher than in metropolitan areas. Accordingly, a value of 50% has been assumed as a national level. Using this value, the estimated numbers of seniors with drivers' licences are listed below according to the seven Urban/Rural Cohorts:

Urban/Rural Cohort	Seniors With Drivers' Licences
Year	(1981)
% Licensed	50%
Urban:	
a) 500,000+	414,200
b) 100,000 - 499,999	131,300
c) 30,000 - 99,999	76,900
d) 10,000 - 29,999	66,400
e) less than 10,000	148,600
Rural:	
f) farm	15,700
g) non-farm	359,300
TOTAL	1,212,400

A moderate increase in these levels is expected over the next 40 years.

Anticipated characteristics of this cohort can be described as follows:

- upper senior income levels,
- more numerous and varied trip patterns,
- over next 20 years concentrations of driving seniors in suburban areas of cities and in rural areas,
- relatively high degree of independence,
- likely preponderance of male seniors in this category,
- increasing number of elderly female drivers.

Although this group can be considered a potential resource in providing low-cost demand-responsive transportation for isolated seniors, as this group ages, particularly when aging beyond 75 years of age, mechanical, sensory, and emotional disabilities will increase. Although statistics

indicate that elderly drivers experience accident rates at no higher than average population levels, the larger numbers of late elderly drivers will call for special measures and standards from authorities (highway agencies, safety bodies, municipalities, vehicle manufacturers, etc.).

Focus Group Overlapping

The above four focus groups (although reflecting specific characteristics of transportation disadvantage) represent large disaggregated subpopulations of services with an overlap of representation between focus groups, discussed as follows:

Transportation Isolated

This will obviously include large numbers of the Ambulatory/Disabled and the Late Elderly groupings. This will include those that cannot afford to own and operate an auto, to hire taxis, or with access to or use of public transit services.

Elderly Drivers

This will include those in the Ambulatory/Disabled and Late Elderly cohorts that have sufficient income, motivation, and physical skills to own and operate a private motor vehicle.

5. TECHNOLOGICAL CONCEPTS AND SYSTEMS, DEFINITION AND EVALUATION

In the previous chapters a review has been carried out of present and future seniors in Canada in terms of demography, travel behaviour and needs, and specific service issues and categories of seniors with deficient mobility conditions. This overview has entailed the review of a number of reports and documents and interviews with authorities and practitioners in the field of seniors and transportation. It is not possible to summarize and outline all of these materials, however a bibliography is attached of relevant documents, plus a list of persons interviewed.

It is apparent from the review of literature and discussions with distinguished specialists in this branch of social welfare and transportation services that in spite of the widespread research undertaken in this field over the last ten years there still remains a lack of information documenting the extent of deficiency and isolation of seniors in the various classes of community.

Nevertheless, as discussed above, it is apparent that deficiencies exist or are anticipated in a number of areas:

- physical isolation of certain seniors;
- lack of consideration in design of passenger vehicles of seniors' special characteristics and needs as users;
- special problems of ambulatory/disabled persons as users of transit services;
- lack of consideration of characteristics of seniors as drivers and as pedestrians;
- need to achieve a more cost-effective level of demand-responsive transportation services;
- the logistical problems expected in the delivery of social services to isolated seniors;

- means for enhancing the use of volunteer drivers in seniors' oriented transportation services.

5.1 Potential Research and Development Projects

Arising out of the above review of seniors' needs and critical deficiency areas, the following list has been prepared of project areas apparently justifying research into their development. These are discussed below in the two categories of: i) technological concepts, and ii) technological systems.

i) Technological Concepts

1. a) Market and Function for All-Purpose Paratransit Vehicle

This topic can be considered in relation to the subject of social service delivery and the development of a suitable vehicle for this purpose. The subject of social service delivery has been discussed in Chapter 4, whereby a need exists for integrating the delivery of a number of social service functions, in both urban and rural areas. This task would require an investigation of such agencies that potentially could participate in a pooled transportation facility for social service delivery (see list page 52). This would entail consideration of such factors as:

- number, demand patterns, and scheduling of trips;
- type and source of vehicle used;
- driver personnel;
- feasibility of ride sharing and schedule integration;
- passenger characteristics, access and physical needs.

A goal of this assignment is the investigation of

the special vehicular requirements of a vehicle suitable to provide an integrated social service delivery program. Vehicle attributes would cover:

- power train;
- size;
- passenger amenities;
- special fixtures for handicapped or disabled passengers;
- equipment storage features.

A final step in this review would be to carry out a national assessment of the potential market for such a vehicle. A prototype for this type of vehicle for market analysis purposes could be the GSM vehicle presently under consideration for production and marketing purposes.

1. b) Market and Function of a Mini Passenger Vehicle

Certain countries in Europe and Asia permit the use of mini vehicles (i.e. engine size - 550 to 800 cc., total weight - 900 to 1100 kg.). The use of such small vehicles is prohibited in Canada due to inability to meet structural strength test standards. With the expansion of such factors as: increasing urbanization, cost of fuel, numbers of seniors, and economic difficulties, such mini vehicles could serve an increasingly beneficial role in providing specialized transport in neighbourhood urban and rural communities.
This project would focus on:

- elderly driver characteristics in relation to design and fixtures of mini-automobiles;
- ergonomic features of design of mini-cars;
- assessment of potential market of specially

designed personal mini-vehicle.

1. c) Senior-Oriented Design Criteria for Passenger Transportation Vehicles

With the increasing seniors' population and the accompanying increase of ambulatory/disabled persons, there is a growing need for research and criteria on the ergonomics of use of passenger transportation by ambulatory/disabled persons, of whom seniors constitute approximately 40%. Such disabilities include mechanical, visual, hearing and other forms of disability.

Public transit agencies in urban municipalities are at present dealing with such problems with their own resources, and would likely benefit from a vigorous and integrated program of research and development oriented to Canadian conditions. The application of such a program to all modes of public and commercial transportation would benefit from the similar context and conditions applied to public transit services. These would include rail, inter-city bus, commercial air services, and ferry services.

This assignment would cover:

- review of ambulatory but disabled seniors and physical problems encountered in their use of passenger transportation vehicles;
- ergonomic analysis of mechanical needs of public transit vehicles, terminals, etc.;
- estimate of present and future population groups benefitted by use of design criteria, costs of retrofitting, etc.

1. d) Scope of Non-Automotive Type Vehicles

In other parts of the world, examples exist of

extensive use by seniors of small, non-automotive vehicles. These include specially designed tricycles, mopeds, motorized carriers, etc. This assignment would examine:

- the equipment available and their characteristics;
- review of possible applications for Canadian seniors;
- the potential market in Canada for such vehicles.

1. e) Technical Aids for Elderly Pedestrians

Research on pedestrian behaviour of seniors in North America and Europe reveals consistently seniors' problems in the form of pedestrian accidents involving seniors.[1] This is particularly the case with late elderly whose lack of familiarity with driver behaviour and whose deteriorating judgment and behavioural control results in a high rate of pedestrian accidents and fatalities. It can be expected that these conditions will deteriorate as the numbers of seniors increase, accompanied by increasing traffic flows and the widening of arterial streets and intersections. Such conditions can be expected to be more serious. in suburban than in central areas, with dispersed activities, limited pedestrian amenities and poor levels of pedestrian access to commercial services and shopping centres.

A need exists in Canada for an integrated examination of the above conditions and needs in relation to such technical relief measures as:

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[1] a) Canadian Automobile Association, "Special Study of Senior Citizen Pedestrian Accidents," Pedestrian Safety Report, August 1971.

b) Institute for Road Safety Research, "The Pedestrian as Road User," Voorburg, The Netherlands, 1977.

- integrated pedestrian circulation systems;
- shelters, benches, landscaping, street furniture, textured surfaces, etc.;
- traffic signals and control systems;
- pedestrian separation or protection measures;
- design and layout of shopping plazas and activity centres;
- educational and sensitizing programs for both pedestrians and drivers.

ii) Technological Systems

2. a) Computerized Paratransit Services

Current literature[1] reflects the cost inefficiencies of demand-responsive transit services when used by the public at large. Prevailing attitudes are that demand-responsive services generally have application for special welfare service needs (e.g. handicapped, transportation disadvantaged, etc.). A constraint on such services is the diminishing ability of governments to support the necessary expenditures. An important goal therefore is to improve the cost-effectiveness of demand-responsive services.

Considerable research and development has been underway in the use of computer programs in optimizing demand-responsive transit services. These deal with the range of necessary program applications including: communications,
reservations,
dispatching,
scheduling,
information records.

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[1] See Bibliography, References 45, 50, 51 and 56.

Scheduling programs are considered the most demanding and currently the least operational of the above program applications. Research and development projects are underway in Montreal and Toronto to develop and test paratransit service scheduling programs. These cover the use of advance scheduling of paratransit services in large metropolitan areas. ("Advance" scheduling refers to scheduling trips in advance of current day, while "demand-responsive" scheduling refers to same-day response scheduling.)

In order to provide scheduling programs that can be valid for social service delivery systems, and for services in smaller urban centres and in rural areas, the development of the following applications are recommended:

- demand-responsive paratransit scheduling programs;
- scheduling programs for small urban areas and rural systems;
- scheduling programs for social-service delivery systems.

2. b) Conversion of Paratransit Operational Programs to Microcomputers

The advent of the microcomputer presents opportunities for cost and operational efficiencies in the use of computer programs for control and optimization of paratransit services. The application of microcomputers is expected to enable the feasible applications of such programs (see ii) 2. a) above), to smaller scale operations.

It is proposed that an assignment be carried out to convert paratransit operating programs as designed for use on mainframe and minicomputers for use on current microcomputer hardware.

2. c) Training and Control of Volunteer Drivers

An essential component of paratransit services for the use of seniors (demand-responsive services, social-service delivery systems) is expected to be the use of volunteer drivers using either their own vehicles or those owned by public authority. Certain difficulties have been encountered in the use of volunteer drivers for such purposes, i.e.:

- erratic availability;
- inconsistent and unacceptable operating performance (particularly in transporting disabled passengers);
- problems in obtaining system insurance coverage.

The development of methods is needed to upgrade and standardize the performance and skills of volunteer driver pools by such means as:

- driver training and testing programs;
- preparation of performance standards and manuals.

2. d) Travel Information Centres

As discussed above, seniors will experience high levels of disability which will constrain their ability to use transportation services effectively. This is particularly the case when levels of visual or hearing disability, or combinations of these create difficulties of seniors in their awareness and understanding of the transportation services available, both prior to and during the execution of a trip.

This category of need is not confined to public transit services but to the use of inter-city services , such as inter-city bus cruisers, rail

services, commercially scheduled air services, ferry services, etc.
This assignment is proposed as a combined ergonomic and logistical analysis of the needs of seniors in this field, leading to a feasible set of service improvements covering the categories of:

- home information systems (telephone, etc.);
- printed material;
- bus stop or street aids information;
- terminal information systems;
- on-vehicle information.

5.2 Relationship to Focus Groups

The preceding recommended transportation research and development initiatives can be considered to be related to the elderly focus groups discussed in Chapter 4. In each case, the particular technology initiative can not be considered to be beneficial to all persons in the particular focus group. This relationship is discussed as follows.

5.2.1 Technological Concepts

a) Market and Function of All-Purpose Paratransit Vehicle

This project is related to the Transportation Isolated cohort in its use in special paratransit services to the transportation disadvantaged, or as part of a social-service delivery system. Its impact will depend on the extent to which such vehicles are marketed and put into service.

b) Market and Function of Mini Passenger Vehicle

The impact of this project can be considered in two categories. Firstly, for the potential use

by elderly drivers within community environment in both urban and rural areas. Secondly, all classes of seniors can be considered as potential beneficiaries as passengers in such vehicles. Again, the extent of impact will depend on the degree to which such vehicles are marketed and utilized by seniors.

c) Senior-Oriented Design Specifications for Passenger Transportation Vehicles

Any criteria on specification manuals for ergonomic features of passenger transportation vehicles oriented to the use of seniors could potentially benefit all classes of seniors.

d) Scope of Non-Automotive Type Vehicles

It is recognized that the walk mode is a popular form of transportation for seniors, for a variety of reasons. It is likely that these devices (tricycles, motorized carts, etc.) would be of primary benefit to disabled elderly and to late elderly whose faculties are failing.

The use of such vehicles is likely to be confined to specific applications and areas - for example:

- neighbourhood areas in urban suburbs;
- rural communities;
- resort areas and use in summer;
- shopping centres and activity centres.

e) Technical Aids for Elderly Pedestrians

The main focus and benefit of such facilities would be for use by late elderly and other ambulatory/ disabled elderly in urban areas.

5.2.2 Technological Systems

a) Computerized Paratransit Services

The expected focus of door-to-door paratransit services is the transportation-isolated category of seniors. Only high-demand services would justify the use of computerized dispatching, scheduling and other programs.

Current computer programs in operation or in development would likely apply only to 100,000 and over urban population categories. The proposed Research and Development project is intended to develop computerized scheduling programs for wider applications, and for social-service delivery services. This could extend potential benefits to isolated seniors in 30,000 population and over municipalities and to a limited number of rural contexts.

b) Conversion of Computerized Paratransit Programs to Microcomputers

This step would be intended to extend the cost-effective use of computerized paratransit operating programs to smaller-demand systems. It is, however, unlikely to be feasible for low-demand systems in small urban and rural municipalities. This could include some operations in the 10,000 to 29,999 urban population category and in the rural non-farm category.

c) Training and Control of Volunteer Drivers

The preparation of manuals and guidelines for the effective management of volunteer driver training pools could benefit seniors in the transportation isolated category.

d) Travel Information Systems

Since this measure is intended to be directed to all forms of public or commercial passenger transportation it could potentially benefit all travelling seniors. It is, however, intended to benefit seniors with some disability. Accordingly, the transportation handicapped category of seniors could represent an upper limit of potential benefit. In 1976, this represented 16.0% of elderly population.[1]

5.3 Impact Evaluation of Potential Research and Development Projects

Table XI provides an evaluation of the potential research and development projects according to ten criteria. In assessing the overall results of this evaluation, the following priorities can be presented:

First Priority: This can be assigned to the three potential projects:

1. a) Paratransit Vehicle;
1. b) Mini Vehicle;
1. c) Design Criteria for Passenger Transportation Vehicles.

These three elements receive high scores in the impact and user evaluation categories and as well represent potential industrial opportunities.

Second Priority: This level includes:

2. a) Computerized Paratransit Systems;
2. b) Conversion to Microcomputers;

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[1] Data Base Study for the Identification and Quantification of Transportation Handicapped in Canada. Transport Canada, 1979.

2. c) Paratransit Driver Training;
1. d) Non-Automotive Vehicles.

The three system proposals rate high as a result of supporting paratransit systems, while the non-automotive vehicle initiative has potential industrial opportunities.

Third Priorities: This level includes:

1. e) Pedestrian Aids;
2. d) Travel Information.

These do not represent significant industrial opportunities, but nevertheless could provide important service benefits.

It can be concluded that all the above proposed initiatives represent opportunities that justify proceeding with further investigation.

TABLE XI

ELDERLY TRANSPORTATION TECHNOLOGY

Potential Research and Development Projects

• EVALUATION

Proposed Projects	1. Number of Seniors Impacted (1981)	USER EFFECTS (of transportation service)					IMPLEMENTATION			10. Industrial Opportunities	11. Comments
		2. trip type and range	3. accessibility	4. physical range	5. service quality	6. user cost	7. agency cost	8. operating feasibility	9. Focus Groups Impacted		
Technological Concepts											
1. a) Paratransit Vehicle - Market and Function	550,000	all types (including medical, home-service visits)	high (door-to-door)	within community (municipality)	high (some schedule delays)	medium	some government support costs	manufacture and marketing	Transportation Isolated	1. a) potential automotive manufacturing opportunity	impact dependent on marketing
1. b) Mini Passenger Vehicle - Market and Function	1,210,000	all types	high level (door-to-door)	mostly within community (restricted from freeways)	medium to high (possible space constraint)	medium to high (private ownership)	nil for personal use (possible fleet use subsidy)	manufacture and marketing (need revised safety criteria)	Elderly Drivers	1. b) speculative automotive manufacturing opportunity	impact dependent on marketing coverage
1. c) Design Criteria for Passenger Transportation Vehicles	2,360,000	mainly line-haul, fixed-route or intercity trips	via bus stops or terminals	wide range (excludes local service)	requires access leg, waiting phase	low	marginal or limited design adaptation costs	cooperation of carriers and industry	All Seniors	1. c) vehicular parts and fixtures	impact dependent on extent of application
1. d) Scope of Non-Automotive Type Vehicles	450,000	local, neighbourhood trips only	no constraint, personal vehicle	limited physical range, local area	limited likely unsheltered	low cost vehicles	minimal (personal ownership)	manufacture and marketing	Ambulatory/Disabled	1. d) speculative manufacturing opportunity	impact dependent on marketing coverage
1. e) Technical Aids for Elderly Pedestrians	453,500 (1981) 837,900 (2001) 1,382,700 (2026)	walk trips in intensive urban areas	not applicable	pedestrian range	not applicable	nil	capital costs - primarily municipal authorities	implementation by municipality and developers	Late Elderly and Ambulatory/Disabled (urban)	1. e) street hardware (shelters, barriers, etc.)	gradually growing effect
Technological Systems											
2. a) Computerized Paratransit Services	134,200	all types (including medical, home-service visits)	high (door-to-door)	within community (municipality)	high (some schedule delays)	insignificant	primarily transit operator costs (likely government subsidies)	implementation by operators and agencies	Transportation Isolated (10,000+ urban)	2. a) computer software development	extension of existing computerized systems
2. b) Conversion of Paratransit Operating Programs to Microcomputers	187,400	all types (including medical, home-service visits)	high (door-to-door)	within community (municipality)	high (some schedule delays)	insignificant	primarily transit operator costs (likely government subsidies)	implementation by operators and agencies	Transportation Isolated (10,000+ rural, non-farm)	2. b) computer software development - extended use of microcomputers	impact depends on size of operation
2. c) Training and Control of Volunteer Drivers	550,000	all types (including medical, home-service visits)	high (door-to-door)	within community (municipality)	high (some schedule delays)	insignificant	medium (possible government subsidy)	implementation by operators and agencies	Transportation Isolated	2. c) limited manufacturing potential	
2. d) Seniors Travel Information Systems	533,800 (1981) 986,600 (2001) 764,300 (2026)	mainly line-haul, fixed-route or intercity trips	not applicable	wide range (excludes local service)	access leg, waiting phase required	insignificant	medium development and capital costs	implementation by operators and authorities	Transportation Handicapped	2. d) communications equipment and fixtures	

APPENDIX A

REFERENCES

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APPENDIX B

BIBLIOGRAPHY

1. Demography

1. Andreae, Antonia E., "Senior Citizen's Housing, Locational Considerations and Social Implications". Centre for Urban and Community Studies, University of Toronto, August, 1978.

2. Central Statistical Services, Ontario Ministy of Treasury and Economics, "Population Aged 65 and Over in Ontario", Demographic Bulletin, Volume 5, Numbers 10, 11, and 12, October, November, and December, 1981.

3. Nitkin, D., "Changing Demographics: Outlooks for the 1980's". Presentation to the Canadian Urban Transit Association, November, 1980.

4. Public Affairs Directorate, Department of National Health and Welfare, "Canadian Governmental Report on Aging". Catalogue No. H21-89, June, 1982.

5. Secretariat for Social Development, "The Elderly in Ontario: An Agenda for the 80's". Government of Ontario, December, 1981.

6. Senior Citizens Bureau, "Older Persons in Alberta: Their Use of Programs and Services". Alberta Social Services and Community Health, June, 1982.

7. Senior Citizens Research Committee, "Property Taxes and Other Problems of the Elderly in Nova Scotia". Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia, January, 1980.

8. Statistics Canada, "Canada's Elderly". Catalogue No. 98-800E, March, 1979.

9. Statistics Canada, "Expenditure Patterns and Income Adequacy for the Elderly, 1969-1976". Catalogue No. 13-575, June, 1980.

10. Statistics Canada, "Population Projections for Canada and the Provinces, 1976-2001". Catalogue No. 91-520, June, 1980.

11. Stone, Leroy O. and Fletcher, Susan, "Aspects of Population Aging in Canada, a Chartbook". Statistics Canada, National Advisory Council on Aging, June, 1981.

12. Systems Approach Consultants Ltd., "Data Base Study for the Identification and Quantification of Transportation Handicapped Persons in Canada". Prepared for Transport Canada, May, 1979.

13. Transportation Outlooks Office, "Outlooks on Contemporary Lifestyles in Ontario". Ministry of Transportation and Communications, October, 1980.

2. Travel Behaviour

14. Ernst, Ulrich and Everett, Carol, "Elderly Mobility and Transportation Services: Some New Survey Evidence". The Urban Institute, Washington, D.C., January, 1981.

15. Canadian Automobile Association, "CAA Special Study of Senior Citizen Pedestrian Accidents". Pedestrian Safety Report, August, 1971.

16. Gryfe, C.I., "The Aging Driver". Scientific and Business Meeting, Ontario Chapter, College of Family Physicians of Canada, Toronto, 5 October, 1977.

17. Institute for Road Safety Research, "The Pedestrian as Road User". Voorburg, The Netherlands, 1977.

18. Metropolitan Area Planning Department, "Transit Mobility for Elderly and Handicapped Persons". Wichita-Sedgwick County, May, 1977.

19. Miller, Jack. Alan M. Voorhees and Associates, Inc. "Latent Travel Demands of the Handicapped and Elderly". Transportation Research Record No. 618, 1976.

20. Morris, J. "Personal Mobility and Transport Requirements of the Elderly". Australian Road Research Board, Internal Report AIR 344-1, 1979.

21. Office of Secretary Technology Sharing, U.S. Department of Transport, "Improving Transportation Services for Older Americans". Volume I, General Report, September, 1980.

22. Paaswell, Robert E., and Redser, Wilfred W., "Problems of the Carless". Praeger Publishers, New York, 1978.

23. Parsons, Jock and Woods, Georgia, "A Study of Senior Citizens' Transportation Needs and Services in Ontario". Ontario Advisory Council on Senior Citizens, 1977.

24. Rural Transportation Committee, "An Examination of Transportation Concerns as Expressed by Senior Citizen Clubs and Organizations in Rural Alberta". For Alberta Council on Aging, Edmonton, Alberta, 1978.

25. Rural Development Outreach Project, "Profile of the Transportation Disadvantaged in a Rural Area of Southwestern Ontario". For the Urban Transportation Research Branch of the Canadian Surface Transportation Administration, Transport Canada, March, 1979.

26. Stirner, Fritz W., "The Transportation Needs of the Elderly in a Large Urban Environment". The Gerontologist, Vol. 18, No. 2, 1978.

27. Wachs, Martin, "Transportation for the Elderly". University Press Limited, California University at Los Angeles, 1979.

28. Wade, Philip E., "Transportation and the Elderly: an Ontario Overview". Boston Henry Quinn Associates, Toronto, March, 1982.

3. Service Levels and Organizations

29. Bautz, James A., Casey, R., Kendall, D., Page, E., and Spear, B., "Improved Mobility for Elderly and Handicapped Persons". ASCE, Transport Engineering Journal, January, 1982.

30. Cooper, Tom, Bloomfield, Pamela, and Flynn, Sydwell, "No Life: Special Needs Transportation in Portland, Oregon". U.S. Department of Transportation, UMTA/TSC Project Evaluation Series, June, 1978.

31. Crain and Associates, "The Roles of Government and the Private Sector in the Provision of Mobility Systems for the Transportation Handicapped". U.S. Department of Transportation, UMTA, August, 1976.

32. Einstein, Ned, "Special Paratransit Service for Elderly and Handicapped Persons". Office of Planning Assistance, Urban Mass Transportation Administration, Washington, D.C., November, 1981.

33. Ernst, U.F.W., Rosenbloom, S., Everett, C., Kemp, M.A., "Coordinating Transportation Sciences for the Elderly". Project Report, The Urban Institute, Washington, D.C., September, 1980.

34. Henry, Wallace J., "Car Pooling: Analysis". Metropolitan Toronto Transportation Plan Review, February, 1974.

35. IBI Group, "Documentation and Evaluation of the Disabled Adult Transportation System Demonstration Project". For Urban Transportation Research Branch, Canadian Surface Transportation Administration, Transport Canada, January, 1978.

36. The Institute of Public Administration, "Improving Transportation Services for Older Americans". Sponsored by the Administration on Aging, of the Department of Health and Human Resources, Washington, D.C., September, 1980.

37. Lehnen, Agnes, and Suen, Ling, "An Overview of Para Transit Activities in Canada". TP 1464, Urban Transportation Research Branch of the Canadian Surface Transportation Administration, April, 1978.

38. Pio, Allesandro, "Cost and Productivity of Transportation for the Elderly and Handicapped: A Comparison of Alternative Provision Systems". Transportation Research Record 784, 1980.

39. Spear, Bruce D., "Service and Methods Demonstration Program Report". U.S. Department of Transportation, December, 1981.

40. Technology Sharing, "Transportation for the Elderly and Handicapped, Programs and Problems 2, U.S. Department of Transportation, Washington, D.C., February, 1981.

4. Transportation Technology

41. Barkow, B, and Berg, A.S., Systems Studies Dimension, "An Assessment of the Human Factors of Transportation Services for the Handicapped". Paper for Urban Transportation Research Branch, Transport Canada Research and Development Centre, May, 1977.

42. Bentzen, B.L., Jackson, R.M., and Peck, A.F., Boston College, "Improving Communications with the Visually Impaired in Rail Rapid Transit Systems". Report to Urban Mass, Volumes I and II, Transportation Administration, Washington, D.C., August, 1981.

43. Canadian Rehabilitation Council for the Disabled, Toronto, Ontario, "Urban Transportation Services for the Physically Disabled Persons in Canada". Information Directory, December, 1981.

44. Duncan, J., Transport and Vehicle Systems Research and Development, "Review of Electric Vehicle Developments, 1980 and 1981". Reports to Ontario Ministry of Transportation and Communications.

45. Glazer, L., Courington, W., Barnett, D., and Ross, Samuel, Crain and Associates, "Commuter Information System: A New Ride-Sharing Tool". Transportation Research Record, Transportation Research Board, Washington, D.C.

46. GSM Design Inc., "Magna GSM, Utility Vehicles". Brochure for Magna International, 1982.

47. Henderson, W.H., Thomas, D.D., Management Services Associates, "Equipment Selection for Systems Transporting the Elderly and Handicapped". Technology Sharing, U.S. Department of Transportation.

48. Henry, W.J., Boston Henry Quinn Associates, "Emergency Medical Information System". Unpublished paper for Health Insurance Division, Ontario Ministry of Health, January, 1983.

49. Kaulbach, P.J., and Enyou, N.D., DelCan, "Para-Transit Vehicle Technology: Guidelines for Regulators, Operators and Vehicle Developers". Prepared for Transportation Development Centre, Transport Canada, Montreal, June, 1982.

50. Miller, E.J., Ahlin, F.J., Bunt, P.D., Bookbinder, J.H., Woolff, R.N., Toronto/York Joint Program in Transportation, "Wheel-Trans: Feasibility of Computer-Aided Reservations, Scheduling and Dispatching". Research Report No. 73, November, 1980.

51. Pro-Data Services Ltd., "Transportation for the Handicapped. A Feasibility Study of Computer-Aided Scheduling and Dispatching". Prepared for Urban Transportation Research Branch, Canada Surface Transportation Administration, Transport Canada, January, 1978.

52. Road and Motor Vehicle Traffic Safety Branch, "An Evaluation of Some Current Light Urban Vehicles", and "Fuel Economy and Safety Impacts of the use of Light Urban Vehicles". Transport Canada Report, September, 1981.

53. Rutenberg, U., Design Douglas Ball Inc., "Barrier-Free Surface Transportation Terminals: Design Considerations". Prepared for the Urban Transportation Research Branch, Canadian Surface Transportation Administration, Transport Canada, December, 1978.

54. Transit Office, "Training Guidelines for Drivers of Transportation Services for Physically Disabled Persons". Ontario Ministry of Transportation and Communications, May, 1981.

55. Transportation Development Centre Montreal, "Transportation in Canada: A Guide for Travellers with Special Needs". Transport Canada, December, 1981.

56. UMTA Technology Sharing, "Advanced, Area-Coverage, Automatic Vehicle Monitoring Program". Program Fact Sheet, U.S. Department of Transportation, July, 1980.